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AUTHOR	Stansberry, Steve; And Others
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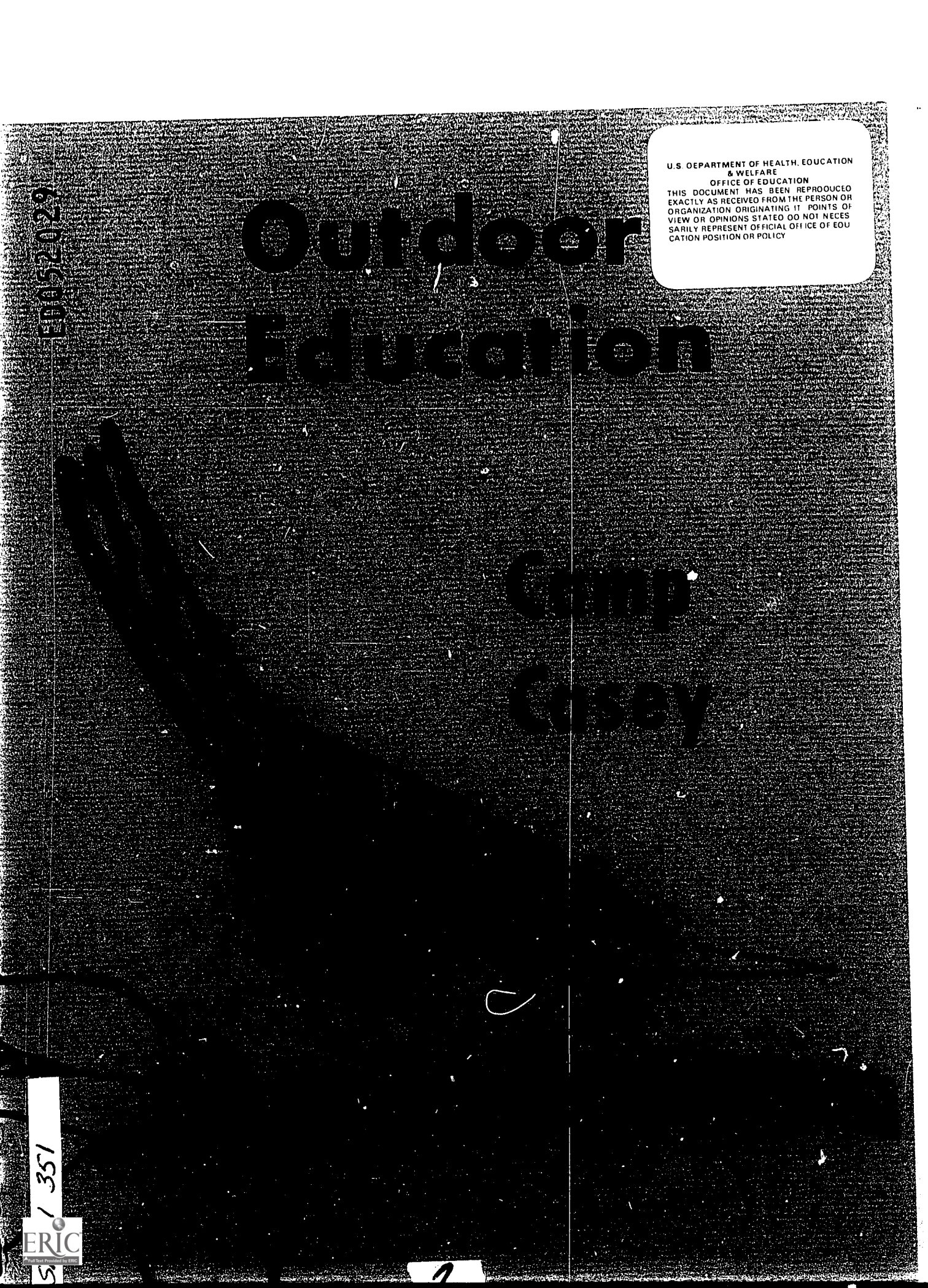
ABSTRACT

A curriculum guide for the Camp Casey Outdoor Education program is contained in this document. Designed for fifth grade students and teachers in Northshore School District, Bothell, Washington, it emphasizes learning activities for use in the outdoors. General understandings relevant to the objectives of the program form the frame into which the activities are placed. Most activities are appropriate for use in school or community locales and can serve as preparation for experiences at a campsite. Section I enumerates items to consider in preparing the student for a camping/outdoor education situation. Remaining sections deal with study units in geology, history and social studies, survival and simple outdoor navigation, saltwater ecology, and plants and animals above the tidal zone. Individual units present several general understandings each with specialized background information and suggested activities. Student worksheets, diagrams, vocabulary lists, reference lists, and teaching aids complete the guide. (BL)

Outdoor Education

Camp Carl



OUTDOOR EDUCATION

CAMP CASEY

A curriculum guide for the

Camp Casey Outdoor Education Program

Developed by:

Steve Stansberry
Ella Colson
Helen Bowers
Marie Sands
Marty Campbell
Ken Sundin
Herman Gold
Arlan Kronfus
Earl Mastin
Susan Peterson
Karen Serkland
Dave Spilman
Cliff Sundin
Jim Park
Alan Buchanan,
Dick Giger

Northshore School District #417
18315 Bothell Way N.E.
Bothell, Washington 98011

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FOREWORD

This guide has been developed through cooperative endeavors of many persons who are dedicated to the values of outdoor education as a vital part of the educational experience of the elementary youth of Northshore School District.

The guide endeavors to ensure participating students of an invigorating, wholesome group-living experience that will lead to a more thorough appreciation and understanding of the natural environment with which we are blessed in western Washington.

It is the hope of all persons involved in the planning of this outdoor educational experience that it is only the initial step in an awe-inspiring life appreciation of the world of nature.

Lee Blakely
Assistant Superintendent

INTRODUCTION

From an idea in one teacher's mind and a one classroom venture, the Outdoor Education Program in Northshore District has grown to include fifth-grade students in all Northshore elementary schools.

The program started and developed by classroom teachers, has grown successfully upon characteristics which naturally apply to and appeal to growing boys and girls.

a. CURIOSITY - The child's curiosity about his environment is unlimite .

b. APPRECIATION - Knowing more about natural surroundings leads to deeper understanding and appreciation.

c. APPLICATION - The great outdoors offers endless opportunities to apply learning to real-life problems and social interaction in natural situations.

d. CONSERVATION - Familiarity with and appreciation for the out-of-doors leads to interest and practice in saving everyone's great natural heritage.

Development of the program has progressed to the production of a guide which emphasizes learning activities for use in the outdoors. General understandings considered germane to the objectives of the program form the frame into which has been placed a body of specific and pertinent activities. The outdoor education guide is oriented toward a Camp Casey outing. Most of the learning activities are appropriate for use in school or community locales and will serve as preparations for experiences planned for the Camp Casey site.

TABLE OF CONTENTS

SECTION I

PREPARING THE STUDENT FOR OUTDOOR EDUCATION

The preparation of your pupils should not be a difficult task; instead, it should be integrated with the regular school studies. Each individual teacher determines the amount of time spent in preparation. However, by beginning early, you should be able to tie in the experiences which are necessary with regular class discussions and activities in the various subject areas.

It is important that the pupils understand that Outdoor Education is not just an opportunity for them to have a vacation from regular school. Of course, they should know that living at the outdoor education site is fun, but it is also a place where they can learn through first-hand experiences with nature's growing things. Remember, your pupils will be working in a completely new educational environment. Therefore, they should realize it is important for them to learn all they possibly can about the natural sciences and, at the same time, live cooperatively with others.

You should also inform them they will be taught by several teachers and supervised by student leaders (either parents or high school students). They should understand they are responsible both to the student leaders and the teachers. They should be aware that the student leader is their friend and is willing to help them at all times. It is important to explain that one of the main purposes of this type of experience is to learn to live together with their fellow classmates while cheerfully accepting their living group assignment. They should also become aware of their responsibilities on the bus trip en route to and from camp and while at camp.

The Student Handbook can become the reference guide to help you plan the preparation instruction and review for the students.

Outline of Information for Students

The following details should receive attention through group discussions and class projects during the preliminary planning in the classroom. Consult the sections in this guide on Camp Safety Procedures and Let's Have A Great Camp.

An Introduction to the Curriculum

1. Orient your pupils to the Outdoor Education site by showing slides, followed by a question-answer period. Use the Student Handbook throughout the entire preparation period.

2. Discuss with the pupils the classroom studies in preparation for the outdoor education experience.

The Outdoor Education Site (Camp Casey)

1. Orient the pupils to the Camp Casey site by displaying drawings, maps, and pictures.
2. Inform the pupils of the location of the site, the length of time it takes to get there, and the time they will leave and return.
3. Invite the Director to visit the classroom and explain to the pupils what the campsite is like, what kinds of buildings are in the camp, and who the student leaders and instructors will be during their stay at Camp Casey.

Necessary Information to Tell Parents

1. Inform your pupils of the date scheduled for the parents' orientation. meeting and discuss how important it is for them to attend.

Health and Safety

1. Discuss with the pupils the need and value of practicing daily health habits while at Camp Casey.
2. Discuss health and safety conduct rules, especially when they are in their barracks, in the dining hall, in the recreational areas, on the trails and on the beach.
3. Discuss students' conduct while on the bus.
4. Discuss camp safety concerning fire, accidents, use of camp tools, etc.
5. Discuss what happens if they get sick while at Camp Casey; tell them that there will be a nurse present at all times.

Student Groupings

1. Discuss with the pupils the opportunity which they will have to meet fifth graders from other schools.
2. Explain the different kinds of groupings they will experience at Camp Casey (i.e., activity groups, living groups, buddy system.)
3. Encourage them to establish standards of conduct as regards behavior and civic responsibilities for democratic group living such as:
   a. Respect for the rights of others
   b. Acceptance of responsibilities
   c. Acceptance of the decisions of the group

d. Respect for the right of everyone to voice an opinion

e. Importance of working together cooperatively

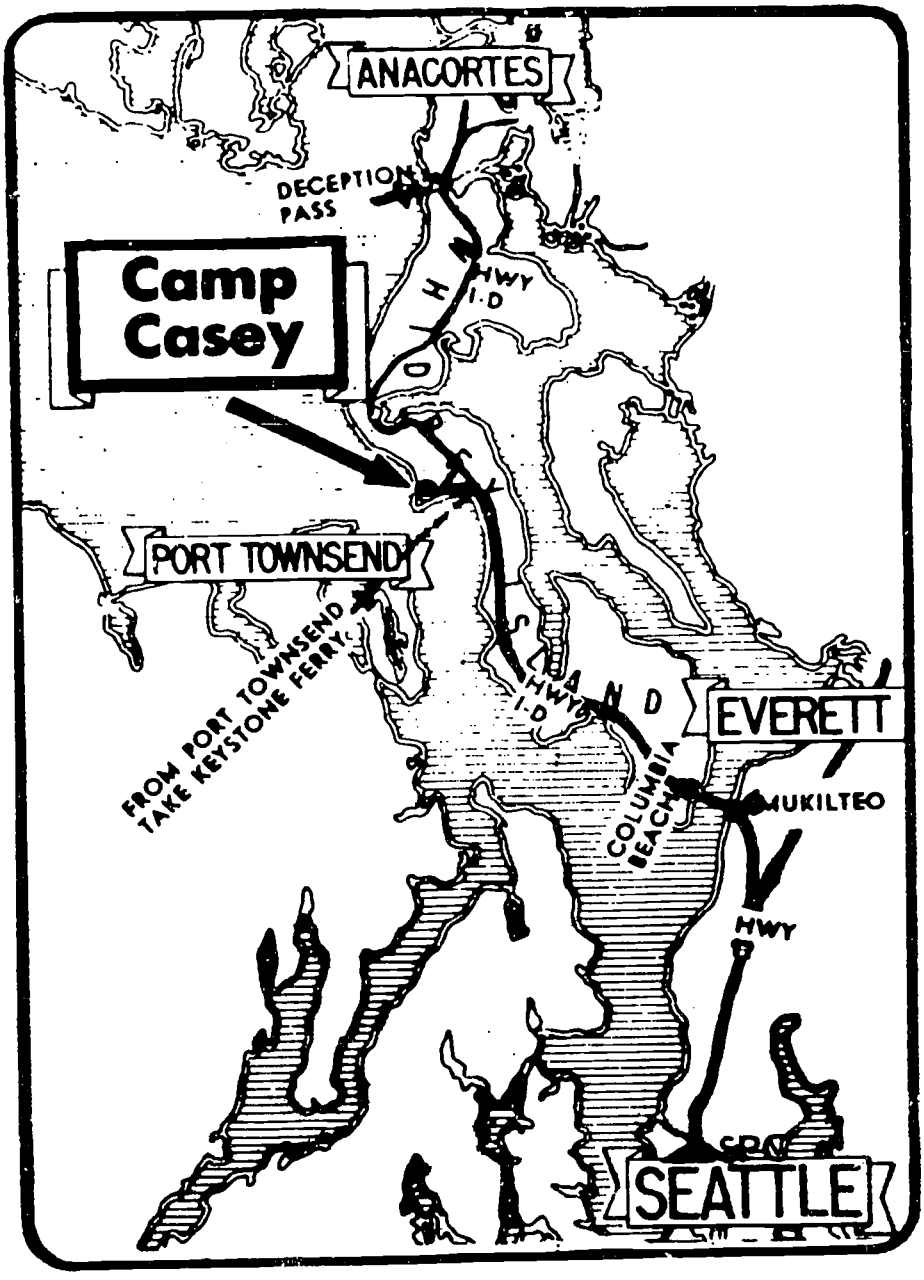
f. Importance of being friendly and cheerful

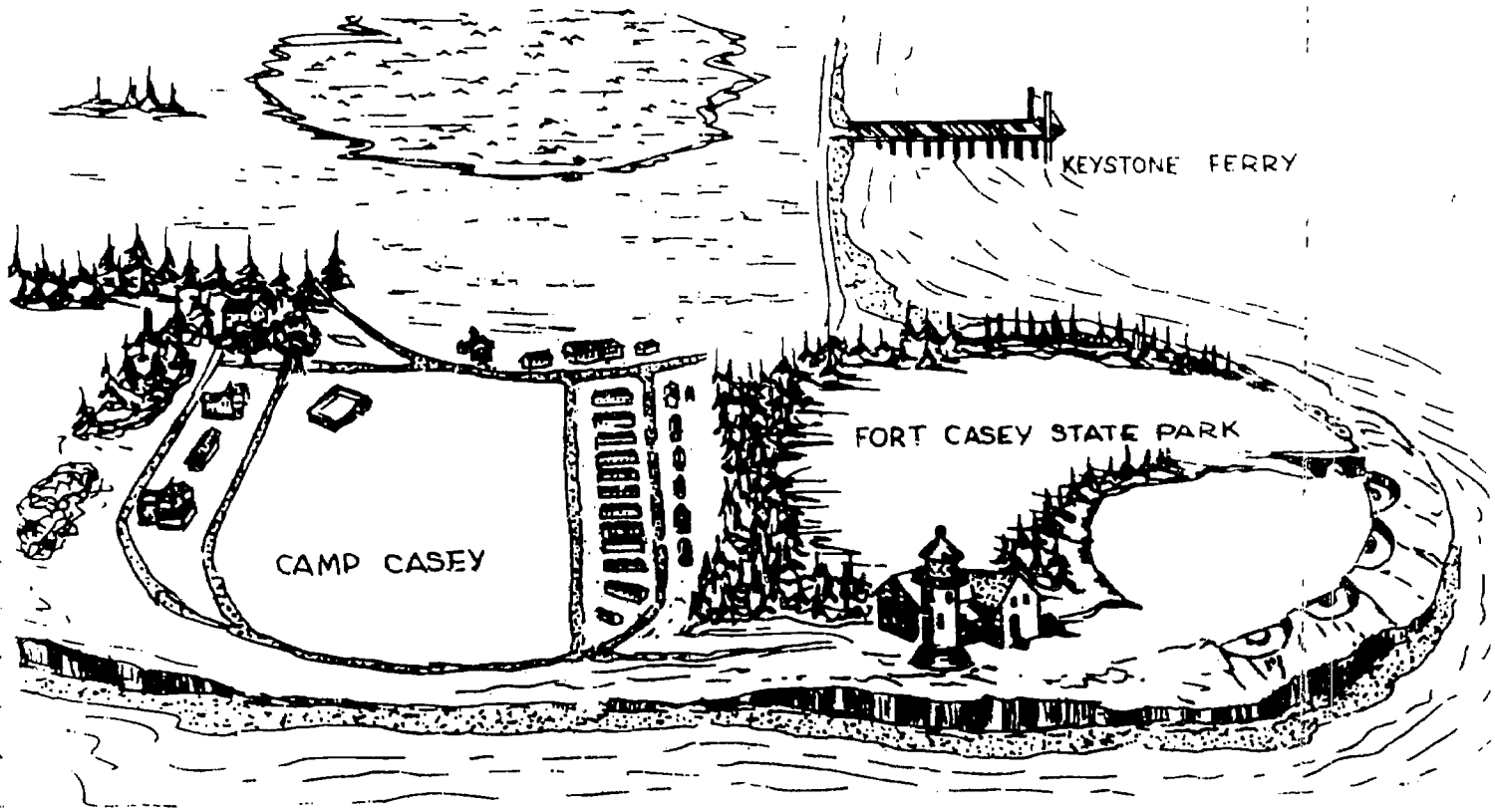
Miscellaneous

1. Discuss with the pupils the daily schedule; stress the importance of regular bed time and rising time. Also, explain what is meant by "quiet time." (signal: hand-in-air)
2. Discuss what they can do during their free time.
3. Discuss what happens if it rains; stress the importance of taking rain gear with them.

Necessary Clothing and Equipment

1. Discuss with the class the necessary clothing and equipment each one needs to take. (See checklist)
2. Emphasize the importance of checking carefully the suggested clothing and equipment list; find out if they do not have some of the items. Also, discuss what items would not be suitable to take.
3. Discuss the importance of filling out the clothing inventory form and placing it on top of their clothes when they pack their suitcase.
4. Discuss how to dress while at Camp Casey.
5. Provide time in the regular school schedule for the pupils to make tags for luggage and bedrolls.


ANACORTES
DECEPTION PASS
Camp Casey
HWY I-D
PORT TOWNSEND
FROM PORT TOWNSEND TAKE KEYSTONE FERRY
SR HWY I-D
EVERETT
COLUMBIA BEACH
MUKILTEO
HWY
SEATTLE


KEYSTONE FERRY
FORT CASEY STATE PARK
CAMP CASEY

CAMP CASEY FACILITIES

Dormitories

1. (#104 & #105) Two-story dormitories to accommodate approximately 150 students.
2. (#107) Bottom floor will accommodate about 30 people.

Auditorium

1. Upper floor of dormitory #107.
2. Bench seating for nearly 150 people.

Kitchen

1. Building #41 on map.
2. Cafeteria style facilities which will accommodate 120 at a time.
3. It may be necessary to schedule meals in two sessions on one-half hour intervals.

Classroom

1. Building #33.
2. Equivalent in size to two classrooms.

Biology Laboratory

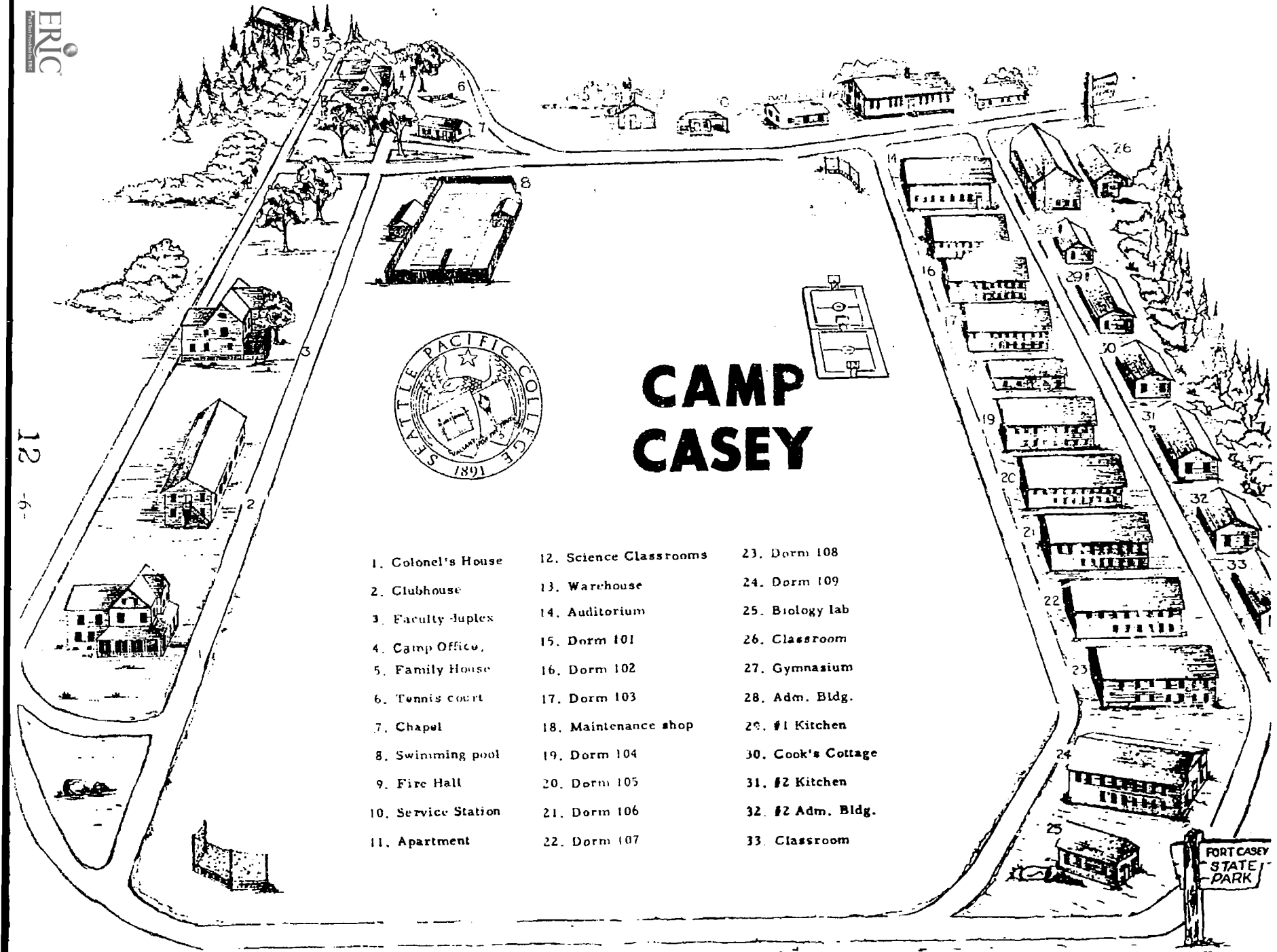
1. Building #25.
2. Houses saltwater laboratory.

Administration Building

1. Building #32.
2. A cottage which includes a living room, 4 bedrooms, (8 beds), and a bathroom.
3. An excellent facility for nurse and camp director.

Swimming pool

1. A heated freshwater pool.
2. Large enough for about 40 swimmers per session.



1. Colonel's House
2. Clubhouse
3. Faculty duplex
4. Camp Office
5. Family House
6. Tennis court
7. Chapel
8. Swimming pool
9. Fire Hall
10. Service Station
11. Apartment
12. Science Classrooms
13. Warehouse
14. Auditorium
15. Dorm 101
16. Dorm 102
17. Dorm 103
18. Maintenance shop
19. Dorm 104
20. Dorm 105
21. Dorm 106
22. Dorm 107
23. Dorm 108
24. Dorm 109
25. Biology lab
26. Classroom
27. Gymnasium
28. Adm. Bldg.
29. #1 Kitchen
30. Cook's Cottage
31. #2 Kitchen
32. #2 Adm. Bldg.
33. Classroom

CAMP STAFF

Resident Camp Director

1. Overall responsibility for Northshore Outdoor Education Program at Camp Casey site.
2. Available to assist with each Session Director.

Session Director

1. Responsibility for each three-day outdoor-education session.
2. The participating schools select a director for each session from their combined staff.
3. Specifically responsible for assemblies, announcements, staff meetings, emergencies, and decisions.

Instructors

1. Teachers and resource people.
2. Instructors responsible for instructional activities and other camp activities.

Group Leaders

1. Parents and/or high school and college students. (1 per 8 recommended.)
2. Group leaders responsible for supervision of camp living groups as outlined in the Student Leader Handbook.

Kitchen Crew

1. Head cook.
2. Helping cooks (3 per school or 6 per session)
3. K.P. helpers and hoppers.
   a. Students and group leaders.
   b. Scheduled on rotational basis for table setting, dishwashing, and cleanup at each meal.

Camp Nurses

1. Public Health nurses or registered nurse.
2. Available for accidents and illnesses.
3. Medical facilities available in Oak Harbor or Coupeville.

Lifeguard

1. High school, college student, or parent.
2. Must be a qualified Red Cross Guard.

Resident Caretaker

1. Employed by Seattle Pacific College to be responsible for supervision and maintenance of all Camp Casey facilities.
2. Melvin Kroon, resident caretaker, lives in camp office (building #4) on map.

TENTATIVE CAMP CASEY DAILY SCHEDULE

DAY #1

9:15	Depart school for Camp Casey
10:00	Ferry--Mukilteo
11:00	Arrive--Camp Casey (assign bunks and unpack)
11:30	Assemble--flag area (colors)
11:45	Sack lunch
12:15	Assemble--flag area--announcements re: afternoon activities Fire drill.
12:30	Camp orientation (What? Where?)
1:00	Afternoon activities (See suggested activity rotation.)
2:30	Snack
5:00	Assemble--barracks (Cleanup for dinner)
5:30	Dinner Group B
6:00	Dinner Group A
6:45	Free time--barracks only
6:55	Assemble--flag area--announcements re: evening
7:00	Evening program--designated areas as scheduled--see page 15
8:30	Evening snack--kitchen
8:45	Prepare for bed
9:15	Lights out and taps
9:30	Staff meeting--Cooks' cottage

(Barracks supervision during staff meetings--2 adults per floor per barracks)

TENTATIVE CAMP CASEY DAILY SCHEDULE

DAY #2

7:00	Reveille
7:20	Assemble--flag area (colors and announcements)
7:30	Breakfast Group A
8:00	Breakfast Group B
8:30	Cleanup and barracks inspection
8:30	Assemble--flag area (announcements re: morning)
9:00	Activities begin--see suggested rotation page 12
10:30	A.M. snack
12:00	Cleanup for lunch
12:15	Lunch Group B
12:45	Lunch Group A
1:20	Assemble--flag area (announcements re: afternoon)
1:30	Activities resume--see suggested rotation page 12
3:00	P.M. snack
4:30	Cleanup for dinner
5:00	Dinner Group A
5:30	Dinner Group B
6:00	Free time--barracks only
6:55	Assemble--flag area (announcements re: evening)
7:00	Evening program (complete Monday activities)
8:30	Evening snack
8:45	Prepare for bed
9:15	Lights out and taps
9:30	Staff meeting

TENTATIVE CAMP CASEY DAILY SCHEDULE

DAY #3

7:00	Reveille
7:20	Assemble--flag area (colors)
7:30	Breakfast Group B
8:00	Breakfast Group A
8:30	Cleanup and pack--barracks inspection
9:00	Assemble--flag area (announcements re: morning)
9:10	Free hike--any area (own choice, group and leader)
11:00	Sack lunch
11:30	Assemble--flag area (lower flag--America)
11:45	Board busses
12:00	Depart Camp Casey
1:00	Ferry--Columbia Beach
2:00	Arrive at school

SUGGESTED ACTIVITY ROTATION

TIME	ACTIVITY #1	ACTIVITY #2	ACTIVITY #3	ACTIVITY #4	ACTIVITY #5	ACTIVITY #6
DAY #1						
1:00--2:30	A	B	C	D	E	F
2:30--4:00	F	A	B	C	D	E
DAY #2						
9:00--10:30	E	F	A	B	C	D
10:30--12:00	D	E	F	A	B	C
1:30--3:00	C	D	E	F	A	B
3:00--4:30	B	C	D	E	F	A

Activity Groups designated alphabetically for convenience in rotation schedule. Activity group size dependent upon number of children participating in each camp session.

LIVING GROUP RESPONSIBILITY SCHEDULE

DAY #1

9:15--1:00	All groups with leaders
1:00--2:30	All groups with instructors except groups H P I J (with leaders)
2:30--4:00	Groups G S Q with leaders
4:00--5:00	All groups
5:00--5:30	Instructors (barracks)
5:30--8:45	All groups
8:45--9:30	Instructors (barracks)
9:30-10:30	Dormitory supervision

GIRLS	BOYS
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

DAY #2

7:20--9:00	All groups
9:00-10:30	F K T R with leaders
10:30-12:00	N V E with leaders
12:15--1:30	All groups
1:30--3:00	C O M B with leaders
3:00--4:30	L A D with leaders
4:30--6:45	All groups
7:00--8:45	All groups
8:45--9:30	Instructors (barracks)
9:30-10:30	Dormitory supervision

GIRLS	BOYS
_____	_____
_____	_____

DAY #3

7:20--8:30	All groups
8:30--9:00	Instructors
9:10-11:00	All leaders and instructors
11:00-12:00	All groups

SUGGESTED EVENING PROGRAM

1. Suggested activities: Night hike, storytelling, fireside, and organized games.

2. Scheduling: rotational basis; 2 activities per evening for two evenings. Forty (40) minutes per activity and 5 minutes passing. Recommended rotation for 4 groups outlined below.

3. Locations for activities:
   a. Night hike (see map)
   b. Storytelling (classroom #33 or #32)
   c. Fireside (campfire area near building #25)
   d. Organized games (auditorium--upper #107)

DAY #1

	Night Hike	Fireside	Storytelling	Games
7:00--7:40	A	B	C	D
7:45--8:30	D	A	B	C

DAY #2

7:00--7:40	C	D	A	B
7:45--8:30	B	C	D	A

TENTATIVE DUTY SCHEDULE

1. Honor Group
   a. Raise and lower the flag
   b. Bugle reveille and retreat
   c. Lead group in pledge and song in morning and evening assembly
2. Fire Group
   a. Gather sufficient firewood for storytelling area and beach fire-side area
   b. Police fire areas and extinguish fires after programs
3. Hoppers
   a. Set tables before meals
   b. Wipe tables after dinner
4. Kitchen
   a. Dump garbage
   b. Assist cooks in washing dishes
   c. Mop kitchen area after meals
5. Dorm sleeping-area cleaners
   a. Police sleeping area
   b. Police lavoratories
6. Ground Crew
   a. Police grounds
7. Loaders
   a. Assist in loading and unloading busses and dispersal of campers' gear

WHAT TO TAKE TO CAMP CASEY

STUDENT CHECK LIST

This list will help you remember what to take to camp. Your teacher will verify your list before you leave. If you bring more than one of the items on the list, indicate the number in the column.

_____ Sleeping bag or 3-blanket bedroll and sheet
_____ Suitcase or dunnage bag
_____ Pajamas
_____ Sturdy shoes or boots
_____ Light shoes or tennis shoes
_____ Socks (4 pair)
_____ Jeans or heavy trousers
_____ Warm jacket (water repellant if possible)
_____ Warm shirt
_____ Light weight shirt
_____ Sweater
_____ Hat or cap
_____ Handkerchief
_____ Underwear (2 pair)
_____ Pen or pencil
_____ Comb or brush
_____ Soap
_____ Toothbrush and paste
_____ Bath towels (2)
_____ Swimsuit
_____ Wash cloth

Optional

_____ Camera
_____ Pillow
_____ Flashlight

All food and snacks will be provided, therefore students should not bring any money or snacks, i.e. candy, gum, etc.

Please double-check the above with your child!

Signed _____
Student

Signed _____
Parent

SUPPLIES CHECK LIST

1. Extension cords and 3-pronged adapters
2. Air horn
3. Record player and records
4. Camera
5. 16 mm projector and films
6. First-aid kit and accident report forms
7. P. E. equipment
8. Binoculars
9. Radio (transistor)
10. Pails
11. Reference books
12. Bug repellent
13. American flag
14. Matches
15. Sewing kit
16. Felt pens, masking tape, paper, pencils
17. Amplified megaphone

To be filled in by the Camp Directors:

Living Group: _____

School: _____

Leader: _____

CAMP CASEY OUTDOOR EDUCATION

Parents: Fill in the following form. Please return it to school not later than Friday, May 7, 1971.

My son/daughter _____
(name of child)
is hereby granted permission to take the field trip to Camp Casey, Whidbey Island May, 1971. It is my understanding that every precaution for the safety of my child will be taken and that proper supervision will be provided by the school. Therefore, he/she may take the field trip and the school district is released of any and all obligations in the event of injury to my child occurring as a result of the field trip.

_____
Parent's or Guardian's Signature

Any child who is unable to attend Outdoor Education Classes to be held at Camp Casey will remain at school in another classroom to work on regular assignments during this time. Please indicate here and sign:

My son/daughter _____ will NOT be attending Camp Casey.

_____
Parent's or Guardian's Signature

There will be a registered nurse at Camp Casey. If your son/daughter is on medication or has any personal problem such as sleepwalking, allergies, etc., please indicate or call:

_____

_____

_____

_____

In case of emergency, we may contact you at the following telephone numbers:

1. _____

2. _____

If we can't contact you, may we have your permission to call a local physician?

YES_____ NO_____

If you have any questions concerning the trip, please call the school principal.

SAMPLE LETTER TO PARENTS

(SCHOOL HEADING)

(Date)

Dear Parents:

On (date), the fifth grade (school) students will depart by bus for Camp Casey on Whidbey Island for a three-day outdoor education experience.

The Camp Casey program has been in the planning stages since early last spring. Parents, teachers, university teaching interns, and students have been working out the details concerning financing, the instructional program, camp activities, and the menu.

Camp Casey is a former military post now being leased by Seattle Pacific College. Several other school districts utilize these facilities for outdoor education programs. The facilities are excellent, providing sleeping barracks, an auditorium, and a kitchen and dining area.

Camp activities will include a tour of the Fort Casey Interpretative Center, hiking, firesides; and evening programs. Art, language arts, and science activities will constitute the instructional program.

On the evening of (day and date and time), we will have an orientation meeting for the parents of the fifth-grade children. This meeting will be held (give place). A few slides of Camp Casey will be shown. We encourage every parent to attend this meeting as all details of the Camp Casey program will be discussed.

Respectfully submitted,

(SCHOOL HEADING)

(Date)

Dear Parents:

The field trip to Camp Casey on Whidbey Island will be from (date). We will depart from the (school name) at 9:15 (date) morning and arrive back at the school at 2:00 on (day) afternoon.

All students are requested to contribute (cost) toward expenses on or before (date). Money is payable to Camp Casey Project Fund.

In case of an emergency you can contact us at Camp Casey by calling 1-678-4459.

We sincerely appreciate your cooperation in helping to make this Outdoor Education Program a meaningful experience.

Respectfully,

SECTION II

GEOLOGY

MAIN UNDERSTANDING

There was a time thousands of years ago when the earth was much colder than it is today. Glaciers covered Canada, large parts of the United States, and most of Europe. The glaciers were so wide and deep that they became one vast sheet of ice over 10,000 feet thick. This great mass of ice left its story written in its path, producing much of our finest scenery and land formations that you see today.

BACKGROUND INFORMATION

There are two main types of glaciers. The largest glaciers are termed continental glaciers. They cover plateau or mountain regions. Glaciers which occupy mountain valleys are termed valley glaciers.

Glaciers form at high elevations or when the temperature is low enough to allow vast amounts of snow to accumulate. As the snow accumulates the weight of the snow compacts it, forcing the air out, thus turning the field of snow into a field of ice, just as you can turn a snowball into an iceball by squeezing hard enough. Great thicknesses of ice accumulate and the bottom of the mass begins to creep and flow outward under the overlying weight and a flowing mass is formed. The ice mass is then a glacier. The movement of a glacier is very slow and must be measured over extended periods of time (days, weeks, or months). Moving ice is a powerful eroding agent. The base of the ice is under considerable pressure and as it moves over the ground it scours out masses of previously broken rock, incorporates these into its base, then uses these fragments as a tool to further abrade the land surface. These fragments are left over the landscape in various forms after the ice melts. The melting of the ice also liberates vast quantities of water. This water discharging down the river valleys also carries with it huge boulders, rock, gravel, sand, and other debris which also act as an abrasive, carving various landforms along the way.

Glaciers change vast stretches of land by heaping up materials they brought down from the mountains. In this way they filled up lakes, blocked up riverbeds, and sometimes even built new land out in the oceans. Whidbey Island is made of material that was pushed along by the giant snowplow action of a glacier and was then left in a heap by the melting ice and snow.

ACTIVITIES

1. Demonstrate abrasive action of a glacier by using a clean ice cube to show that ice is soft and by itself cannot abrade: rub it across clay, plastic or any convenient surface that is not too hard. Then put sand on the surface of the ice cube and show how ice can scratch the surface if it has material to use as an abrasive tool.

2. Demonstrate pressure in relation to glacial movement. On each of two ice cubes place a small square of asbestos board. On one ice cube place a heavy weight; on the other place a light weight. Observe that the cube with the heavy weight melts faster. This will show that the melting point of ice is determined by pressure as well as temperature. The greater the pressure, the greater the amount of ice melted, therefore enabling the glacier to slide more freely on the sheet of water.

3. Look at various topographic maps from various locals to find examples of glacier constructed landforms as opposed to landforms caused by various other forms of erosion.

MAIN UNDERSTANDING

Weathering--another contributing factor responsible for change in land formations.

BACKGROUND INFORMATION

Natural forces that break rock into fragments but do not carry them away are listed under weathering. These natural forces, mechanical and chemical, break up bedrock at or near the earth's surface from exposure to atmosphere, weather, plants and animals. Mechanical weathering or disintegration takes place when rock is cracked, split, or broken into smaller pieces of the same material without changing its composition or identity. The breaking of a granite cliff, for example, into boulders and pebbles of granite, is mechanical weathering. In the daytime, water from rain or melting snow flows into cracks or pockets in the rock. At night when it gets very cold this water changes into ice and expands cracking off chunks of rock. This is called frost action. Another form of mechanical weathering takes place when rocks are heated to extremely high temperatures. A rock is heated by the sun all day long. Bit by bit the rock expands and finally cracks. Plants also play an important part in mechanical weathering by wedging their way into cracks within rocks. After extended growth periods and extreme amount of pressure having been applied by the growing roots, the rocks split. Chemical weathering or decomposition takes place through the alteration or decay of the minerals of a rock into different substances. The

crumbling of a black diabase rock into rusty brown clay is an example of chemical weathering. Chemical weathering of a rock results chiefly from the action of the atmosphere's chemical agents: oxygen, carbon dioxide, acids formed in the soil or carried by the streams.

ACTIVITIES

1. Mechanical Weathering:

   a. Materials: Stove with broiler and ten large pebbles
   Procedure: Put the pebbles in the stove on a tray or in a flat pan and place as near to the broiler flame as you can. Turn broiler on high and leave for a few minutes. In a minute or two you probably will hear loud pops as pieces of the pebbles crack off. This will demonstrate mechanical weathering due to extreme high temperatures.

   b. Materials: Two small bottles with screw tops and water
   Procedure: Fill one bottle with water to the top. Screw the covers tight on both the water-filled bottle and the empty bottle. Place them in a freezing compartment for approximately one hour, possibly longer. You will find that the water-filled bottle froze, expanded, and cracked. The empty bottle did not crack because there was no water to expand and split it open. This will demonstrate frost action.

   c. Materials: One package of whole dried beans and a screw-top bottle full of water.
   Procedure: Cram as many beans as possible into the bottle (some of the water will be forced out). Screw the bottle top on tight and let it stand overnight in a warm place. You will find that the beans which are actually seeds, will swell as they begin to sprout. After approximately one day the beans will have swelled so much that the bottle will crack open. The power to crack open the bottle came from the sprouting seeds. In the same way, rocks can be split apart by seeds that fall into a notch or crack in a rock and then begin to sprout.

   d. Materials: Shoe box, plaster of paris, lima bean seeds, paper towel.
   Procedure: Make a slab of plaster of paris by mixing plaster of paris with water until the mixture is like a heavy cream. Pour this mixture into the top of a shoebox. Lay some lima bean seeds on top of the slab. Cover the seeds with a layer of white paper toweling. Keep the towels moist for about one week. After a week, remove a few of the seeds from the slab. Notice what has happened to the plaster of paris. Leave the

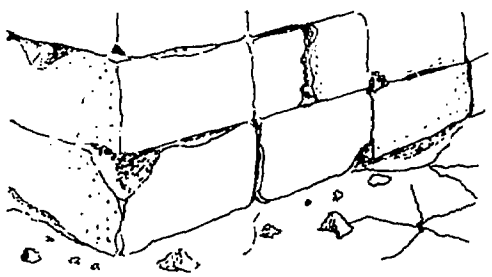
remaining seeds on the slab. Remove a few sprouts every few days. Examine the slab carefully. The roots of the plants dig into the rocks to get minerals in this very same way. This digging helps to break up rock.

2. Chemical Weathering:

a. Materials: Crushed limestone, a beaker, hydrochloric acid or vinegar
Procedure: Place a small amount of crushed limestone in the beaker and cover liberally with weak hydrochloric acid (4 parts water; one part acid) and let stand until dissolved. Explain that acids are found in the soil and water, in streams and lakes as a result of decaying plants and animals. Observe and discuss results.

b. Observe sidewalks, cement roads where broken slabs can be fitted to the parent mass. This will demonstrate frost action.

The diagrams below illustrate the weathering process. Use these diagrams to discuss chemical and mechanical weathering.



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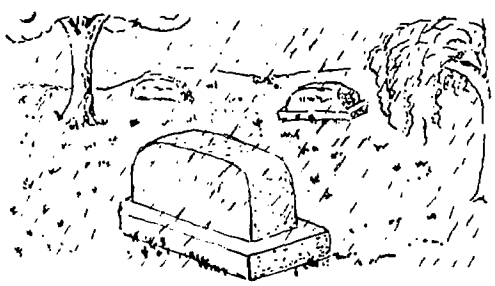

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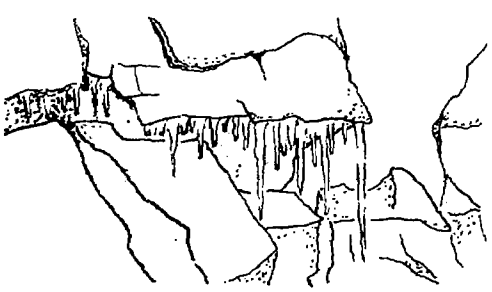


II

IV

MAIN UNDERSTANDING

Water erosion: a contributing factor responsible for change in land formations.

BACKGROUND INFORMATION

Natural forces break rock into fragments and carry them away. Most of the water that does not soak into the ground flows on the surface where it becomes concentrated in streams and rivers. The ability of flowing surface water to abrade, erode, transport, and deposit weathered material makes running water an important sculptor of landforms. Steep slopes erode more rapidly than gentle slopes due to the contributing factor of gravitational forces. Excessive amounts of moisture in the soil combined with gravitational force cause slow invisible downslope movement of soil or service material on even the gentlest slopes. This type of erosion is called creep.

ACTIVITIES

1. Procedure: Observe fence posts, poles, tree trunks, and other objects fixed in the soil on a steep slope to detect a type of mass erosion called creep. This is a direct result of excessive moisture in the soil combined with gravitational forces.

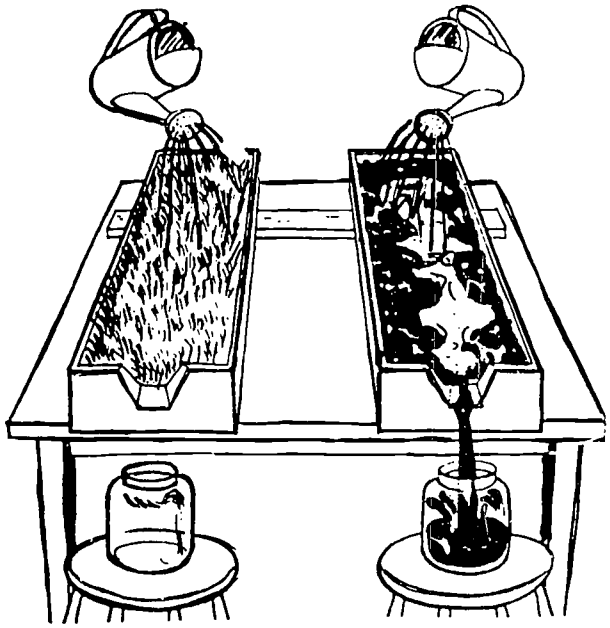
2. Experiment: Water Erosion (Sod versus Bare Soil)

   Purpose: To observe differences in erosion from water running off sod soil and bare soil.

   Procedure: Take two or more wide boards (24 inches or more, long) by (8 inches wide). Tilt on equal slopes fairly steep. Construct a sample soil layer on each with at least one being covered with a layer of sod. Pour equal amounts of water on each sample, preferably with a sprinkling can or tin can with holes punched in the bottom. Pour water, a little at a time, on the soil from the elevated end of each of the soil and sod samples. Observe the results of these tests. Afterward, quickly pour a lot of water on the samples (all at once) so that you have a fast stream flowing. Observe results and discuss. From this experiment you can see that when water moves it carries particles with it. When it moves slowly it can carry along small, light particles such as grains of sand. When it moves more rapidly it can carry heavier things such as pebbles. Note that there was much less erosion taking place on sodded soil. Discuss and explain.

See picture on the following page.

WATER EROSION



MAIN UNDERSTANDING

Wind erosion: a contributing factor responsible for changes in land formations.

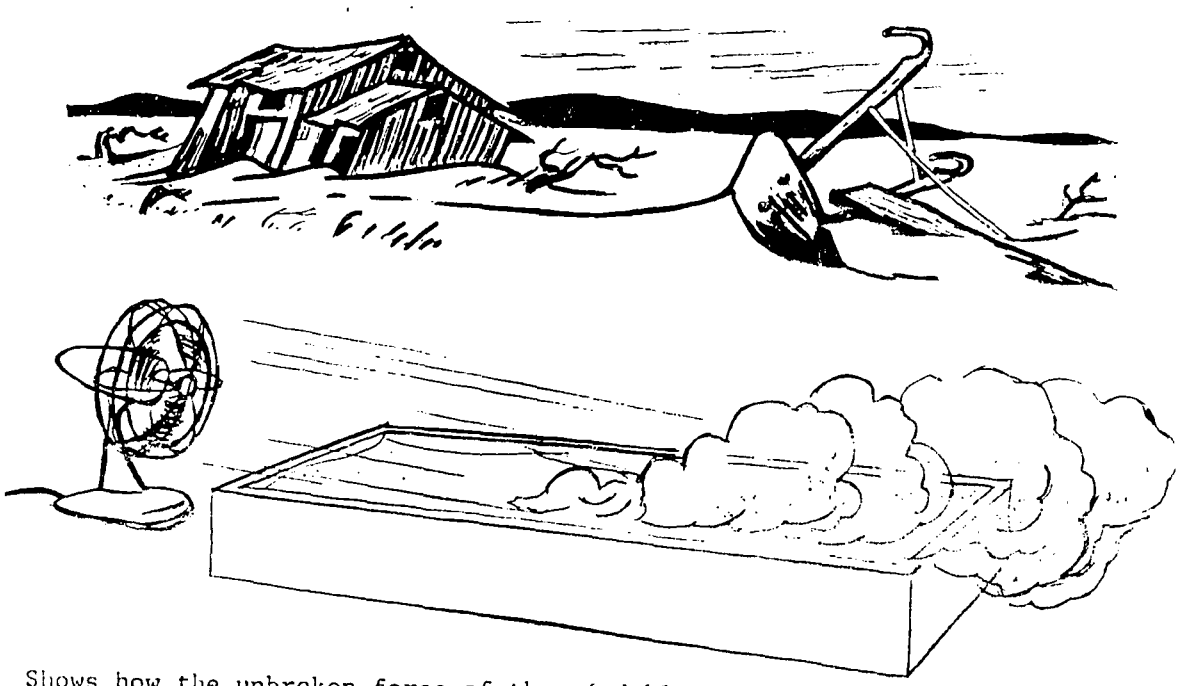
BACKGROUND INFORMATION

Sand that is blown by the wind can scratch and scour and wear away very hard materials. In time it can wear away even the hardest rock. Bit by bit over thousands of years hills and mountains have been carried away by the wind-blown sands.

ACTIVITIES

1. Procedure: Pour a dry sand on the bottom of a large carton or cardboard box. Turn fan on the particles and observe what happens. This will show how the unbroken force of wind blows soil away.

2. Procedure: Have students place their bare arm into the wind flow which is carrying the sand particles to feel the sting of the sand grains as they strike their skin. This will show that wind can make sand scratch and scour like sandpaper. Discuss and draw conclusions.



Shows how the unbroken force of the wind blows soil away.

Examples of Landscapes Due to Erosion

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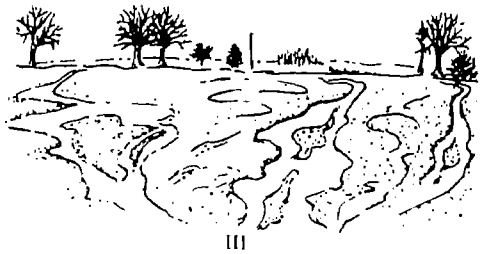

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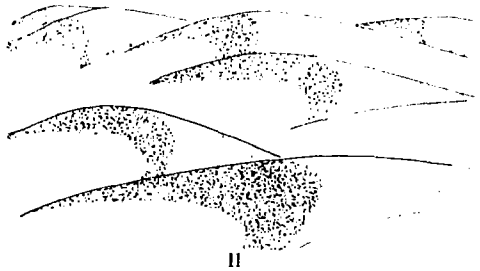

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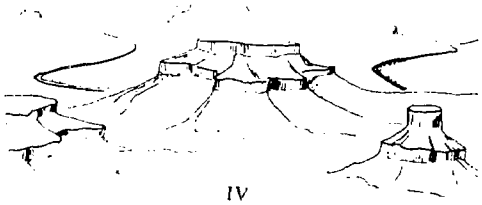
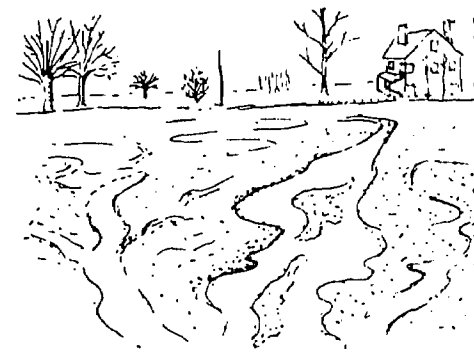


IV

1. Which landscape shows development by glacial erosion? _____
2. Which landscape shows development mainly by water erosion? _____
3. Which landscape shows development mainly by wind erosion? _____

Types of Erosion

I



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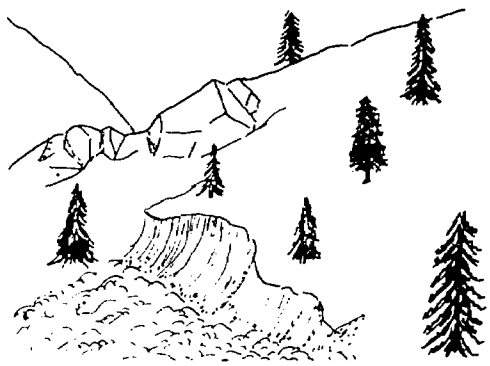

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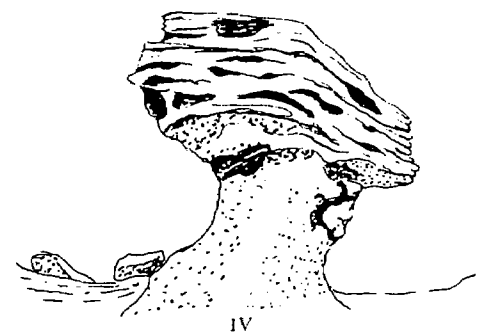


IV

1. Which diagram shows erosion taking place most slowly? _____

2. Which diagram shows erosion taking place most rapidly? _____

3. Which diagram shows erosion taking place mainly by rain? _____

4. Which diagram shows gravity to be the most obvious cause of erosion? _____

5. Which diagram shows erosion taking place mainly by wind? _____

6. Using these diagrams, discuss and explain the natural forces involved in these types of erosion.

MAIN UNDERSTANDING

Rock is made up of minerals. Nonliving things of the earth are minerals. There are different kinds of minerals.

BACKGROUND INFORMATION

The outer crust of the earth is made up of rock. This crust is about 25 miles thick. At the surface we find soil, sand, and loose rock. This part of the crust is called mantle rock. Beneath the soil and sand is bedrock. Bedrock is a layer of solid, unbroken rock. But what makes up rock? Are the bedrock and the pebble on the beach made up of the same things? As a matter of fact they are. All rock is made up of one or more minerals. We have plants (vegetables) and animals. But we also have nonliving things. All the nonliving things that make up our earth are called minerals. Scientists have discovered at least 2,000 minerals in and on the earth. Anything not formed by an animal, a plant, or man himself is a mineral. Minerals differ in many ways. They differ in color, size, shape, and hardness. Diamonds are the hardest of minerals. Talc is one of the softest. Most minerals have a certain structure or framework. They have a form known as a crystal.

ACTIVITIES

1. Discuss the differences among minerals, animals, and vegetables. Play the animal, mineral, or vegetable game with children (20 questions).

2. Make a mineral collection in your classroom. Discuss in what ways the minerals are alike or how they differ. Identify and label.

3. Materials: Water, jar, spoon, string, pencil, measuring cup, rock-salt, coffee can, hot plate

   Procedure: Boil a cup of water in a coffee can. Put four teaspoons of rock salt into the water. Stir the salt until dissolved. Keep adding salt until no more will dissolve. When the salt solution is cool, pour it into the jar. Hang a knotted string into the jar by tying it to a pencil and placing it across the top of the jar. Let the string stand for several weeks. Crystals of salt will grow on the string.

4. Procedure: Repeat your crystal experiment with rock salt. This time boil two cups of water. Dissolve the salt as before, then divide the salt water: one cup of salt water into one jar and the other cup into the second jar. Cool one jar of salt water slowly, cool the other jar rapidly by placing it in a refrigerator. Observe the size of the crystals formed in each jar.

MAIN UNDERSTANDING

Sediment and new rocks: what becomes of all the materials that winds, rivers, and other things wear from rocks of the land? The answer is that most of it settles, becoming sediment that forms new deposits of rocks--sedimentary rock.

BACKGROUND INFORMATION

Most sedimentary rocks start forming when silt and grains of sand settle along the riverbeds or on the bottom of lakes and oceans. Year after year these minerals collect and form broad, flat layers called beds or strata. After thousands of years layers of mud, sand, and rock are squeezed into compact layers by the weight of other layers above them. These materials will harden into true rock by the great pressures that are exerted upon them. In many places sedimentary rocks are more than 40,000 feet thick with the older beds at the bottom and the youngest or newest at the top. When many such layers are fitted together, they give us a general outline of the earth's history. Not all sedimentary rocks were made of mud, sand, or gravel when it came down the rivers. Some were made from the shells of the sea. Some of them build a hard shell which is made of lime. Some plants have shells too. Millions and millions of tiny shelled diatoms live in the sea. When a plant or animal dies, its shell sinks to the bottom of the sea. After many years, millions of dead shells pile up on the bottom of the sea. Again the top layer pushes down on the bottom layers. Eventually the shell layer at the bottom turns into stone. The name of this stone is limestone, which is one of the many kinds of sedimentary rock.

ACTIVITIES

1. Purpose: To show how sediment could settle to the bottom of the sea in layers.

   Materials: One large beaker, sand, clay powder, small pebbles, water

   Procedure: Fill beaker half full of water; add small amount of clay powder, sand, and pebbles. Stir the contents thoroughly, place on a flat surface and observe results without being moved for several days. (Drain excess water off and let sediments dry up to form sedimentary rock--repeat to further the effect of strata.)

2. Observe how layers of sediment were built up as you drive along highways which cut through hills made of sedimentary rock.

3. Observe the seashore. You can see sedimentary rock in layers of sediment deposits which emerged from the water from many years.

MAIN UNDERSTANDING

Igneous rocks: deep within the earth is a mass of hot molten material. This material is called magma. Magma is a mixture of minerals. When magma cools igneous rock is formed.

BACKGROUND INFORMATION

Through scientific study scientists have come to know that the inside of the earth is extremely hot. This extreme temperature causes pools of hot molten material called magma to collect deep within the earth. This magma is so hot that it melts rock and at the same time gives off gasses. The magma, with its heat and gasses, builds up tremendous pressures pushing rock aside and squeezing itself through cracks. Sometimes this pressure blows the top off a complete layer of rock. The magma and gasses break through the ground and erupt due to tremendous pressures resulting in what we call erupting volcanoes. The magma that erupts as a hot liquid is then called lava. In time the molten lava cools, turning into igneous rock. Sometimes the magma does not erupt from the earth's surface but cools beneath the ground turning into rock before it gets to the surface. Huge rocks are formed underground in this manner. This kind of rock is also called igneous rock. Therefore, igneous rocks can be found on top of the ground and beneath the earth's surface. They can be found wherever hot, molten magma cooled into solid rock. There are many kinds of igneous rocks, classified according to the assortment of minerals contained.

ACTIVITIES

1. Discuss the several different types of igneous rocks. Make an igneous rock collection in your classroom. Discuss the likes and differences of each in relation to mineral content. Note that some igneous rocks are coarse-grained and formed by slow cooling but others are fine-grained (glassy) and cooled rapidly. Relate to the experiment using rock salt in the previous lesson pertaining to rocks and mineral content.

2. Material: Heatproof baking dish, hotplate, water, red food coloring, dry cereal

   Procedure: Place a heatproof baking dish on a hotplate. Pour three cups of water into the dish and bring it to a boil. Add some red food coloring to the water. Sprinkle some oatmeal, cornmeal, or other dry cereal onto the bubbling water. When the mixture comes to a boil again, lower the heat and watch closely. The surface bubbles and pops as gas escapes. Tiny volcanoes are formed. When the mixture becomes quite thick, allow it to cool. Notice how the surface cracks, folds, and shrinks.

3. Melt glass in a Bunsen burner flame to show viscosity of lava or molten material.

MAIN UNDERSTANDING

Metamorphic rock: the word metamorphic means "change of form." A combination of pressure and heat changes igneous and sedimentary rocks into metamorphic rocks.

BACKGROUND INFORMATION

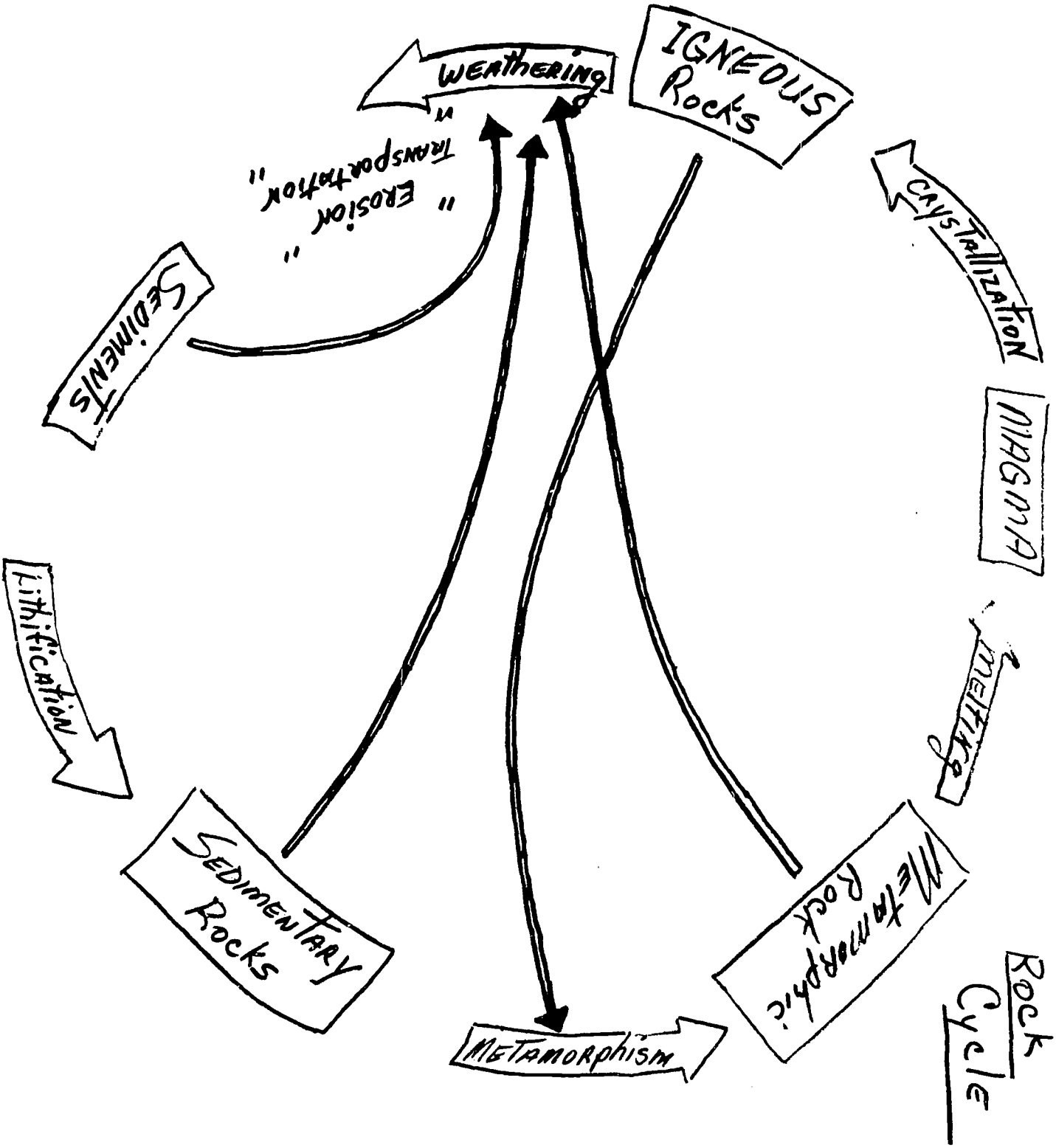
Examination of metamorphic rocks shows many evidences of great pressures. The pressures that produced the changing of igneous and sedimentary rocks into metamorphic rocks are believed to come from two sources. First, the downward pressures caused by the overlying weight of rocks; secondly, there is enormous horizontal pressure that results from movements of the earth's crust during periods of mountain formation. (Example: volcanoes, faults, folding.) Examination of metamorphic rocks also revealsevidences of changes produced by heat and chemicals. Hot magmas are sources of heat and chemicals. Additional heat is believed to come from the friction between moving rock layers during movements of the earth's crust in mountain formation. As the volcano passes through a sedimentary layer, the heat changes the sedimentary rock into metamorphic rock. Sometimes an earthquake causes the rocks to shift. Rocks may break or fold. With all this breaking, shifting, and folding rocks are constantly being squeezed. The pressure builds up to a breaking point and something has to change. The result is igneous and sedimentary rocks change into metamorphic rock.

ACTIVITIES

1. Make a metamorphic rock collection in your classroom.

2. Demonstration: Compare the effects of hydrochloric acid on limestone (sedimentary rock) and marble (metamorphic rock). This will help to indicate that marble might once have been limestone.

3. Discuss how pressure and heat cause folding.
   Experiment: Place a tube of toothpaste on a flat survace. Squeeze it until the whole tube is flat and even. Then, press down on the rear half with your fist. You will find that the front half of the tube will fill and rise. It was pushed up by the paste that flowed over from the rear half. This will show that when you squeeze down at one place causing pressure you cause material to flow away and up into another place where there is less pressure. In this experiment, toothpaste is soft and easy to push. If the tube had been filled with candle wax you would have had to push much harder and longer but the wax would have moved, although very slowly, in the same way that the toothpaste did. Scientists have found by actual experiments that if the tube had been filled with steel or hard rock, the results would have been the same. This may help to give the student an idea of the process involved in folding.


IGNEOUS Rocks
WEATHERING
" EROSION "
" TRANSPORTATION "
SEDIMENTS
LITHIFICATION
SEDIMENTARY Rocks
METAMORPHISM
METAMORPHIC Rock
MELTING
MAGMA
CRYSTALLIZATION
Rock Cycle

VOCABULARY

geology
eroding
topographic
weathering
natural forces
composition
alteration
erode
creep
mantle rock
erupt
lava
viscosity
metamorphic
horizontal
metamorphism
bedrock

glacier
abrasive
debris
disintegration
contract
expand
decay
erosion
gravitational forces
wind erosion
sediment
sedimentary rock
strata
stratification
diatoms
lithification
clay

continental glaciers
valley glaciers
landscape
mechanical weathering
frost action
chemical weathering
concentrated
fragments
abrade
minerals
crust
igneous
magma
molten
limestone
crystalization
silt

ACTIVITIES ON LOCATION AT CAMP CASEY

A field trip to explore, discover, and discuss some of the following concepts which have been previously introduced in the classroom.

1. The work of glaciers and its deposits in its relations to landscape and development of landforms.
2. Evidence of weathering, erosion, and resulting land formations.
3. Collect and identify various types of rocks for classification.
4. Discuss possible previous land formation of Whidbey Island and predict future land formation.

RELATED ACTIVITIES FOR LANGUAGE ARTS

Discuss with the students and explain how they may become influenced by their environmental surroundings. Help them develop their awareness through the use of their five senses (sight, sound, touch, taste, smell). Have them write a short story explaining in their own words the history that is told to them by their interpretation of their natural surroundings.

Some of the influencing factors may be:

sight-- shape of pebbles/shore line/general scenery
taste-- fresh water in a brook/salty taste of the ocean
sound--waves washing against beach/sparrow singing from a tree
touch--feeling of sand sifting through your fingers/feeling of mud squeezing through your toes
smell--smell of a dead fish washed up on the beach/sweet fragrance of the blossoming of Spring

RELATED ACTIVITIES FOR ART

Find a natural source of clay and use to mold and sculpture.

Draw various landscapes related to their study in geology.

Lab Sheet for the Study of Rocks

Classification Chart

	Texture--how does it feel?	Color	Composition--what is it made up of?	Class--igneous, sedimentary, metamorphic?
Sandstone				
Limestone				
Granite				

Other Rocks

Record the properties of any other rocks you may find and name them if you can.

	Texture--how does it feel?	Color	Composition--what is it made up of?	Class--igneous, sedimentary, metamorphic?

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See Elementary Film Catalog, 1970-71, Intermediate School District 110, Classification; Geology

Kits and Models:

Available from the Instructional Materials Center, Northshore School District #417.

Geology and Physical Geology Resource Unit containing the following:

- Set of 8 geology models,
- Stream table with accessories
- Set of 32 rock specimens
- Geology demonstration kit
- Four Science of the Earth Charts:
  - Inside the Earth
  - Changing Surface of the Earth
  - Rocks and Minerals
  - Rocks and Soils
- Map of Geology of the World
- 20 Anaglyphs of the Grand Canyon
- Set of 18 Geology Transparencies

Six filmstrips in color:
- Volcanoes and Earthquakes
- Mountains
- Work of Snow and Ice
- World of Internal Forces
- Common Minerals
- Earth a Great Storehouse

Book: The Earth, from LIFE Nature Library
Set of Cartocraft Teaching Aids in Binder
Storage and Shadow Box

Deluxe Rock Charts
- Igneous rocks chart
- Sedimentary Rocks chart
- Metamorphic Rock chart
- Rock Cycle chart

Overhead Transparencies (Instructional Materials Center)

Science #36--Geologic Functions

Science #37--Rocks and Minerals

Study Prints (Instructional Materials Center)

Earth Science Series
Set #1--Glaciers
Set #2--Volcanoes
Set #4--Erosion
Set #7--Igneous and Metamorphic rocks
Set #11--Sedimentary rocks
Set #12--Earth Movements
Set #13--Minerals
Set #17--Geological Instruments

Earth History Series
Set #1--The Record in the Rocks

SECTION III

USES OF CAMP CASEY

MAIN UNDERSTANDING

Fort Casey at one time served a strategic and tactical function. With the advances in technology and modern methods of warfare, it is now obsolete as a military installation. However, Fort Casey still serves a useful purpose as an area for recreation and study.

Following are some suggested activities. For convenience, background information and/or preliminary classroom activities are listed with the on-site activities.

ACTIVITIES

1. Background Information: See Acquisition of Military Reservation of Admiralty Head and Admiralty Head Light Station in this chapter.
   Activity: Lighthouse Tour

2. Background Information: In this section see Mapping the Schoolyard, Measuring Distance by Triangulation, or consult the mathematics coordinator.

3. Radar Demonstration: Throw a rubber ball against the wall and record time elapsed from release to recovery. A stop watch might be most accurate since you can see release and recovery and punch at each occurrence. As you move away from object, the elapsed time from release to recovery should get longer. This demonstrates electronic echo.

4. Short discussion on history of fort.
   The following questions are for your consideration and are probably most relevant:
   a. Why was the fort built?
      To protect the Puget Sound Naval Shipyard at Bremerton and Seattle. Include short discussion of guns used. May be covered somewhat in the lighthouse tour.. Also covered in Admiralty Head Light Station, this chapter.
   b. How was range determined?
      See Activity 2 and Measuring Distances by Trangulation in this chapter.
   c. How did they know a ship was out there?
      By visual sighting.

d. What if it was night?
They used large searchlights. The housings are still accessible at the edge of the cliff above the beach near the south end of the gun emplacements.

e. What if it was foggy or there was poor visibility?
Picket ships were used. They were small ships which cruised back and forth.

f. Why do you suppose the guns were removed?
They were not needed any longer.

g. What does obsolete mean?
No longer in use.

h. Why do you suppose this fort became obsolete?
General Billy Mitchell of the U. S. Army advocated the use of airplanes for military purposes in the 1930's. He was court martialed and dismissed from the service because of his stand, his demonstrations, and his ideas. The top brass were not yet ready to accept his ideas, but we know that air power became very important in World War II.
This fort was not equipped to ward off aircraft, which could be brought within several hundred miles by carrier and then released to attack over the defenses of Forts Casey, Flagler, and Worden. (Mitchell's ideas were eventually used and he was reinstated, but only a couple of years before his death.)

i. What do you think is used for protection now?
Missiles, aircraft, etc.

j. Why hasn't all this been removed and the buildings torn down?
(For teacher background see pages 48-67 of this section.)

4. Background Information: See Development of Fort Casey, this section. (Sign boards at the fort and the lighthouse may have additional information.)
Activity: Tour of gun emplacements.

5. Background Information: See art coordinator for ideas or have her come to your class for some instruction.
Activity: Sketching or drawing landscape or seascape, or both.

6. Background Information: Learn how to use a compass in class or outside at school. Try to find out declination for this area. Explain declination (the difference between geographical north pole and magnetic north pole).
Activity: Compass reading. Use compasses to locate objects by relative bearings and true bearing.

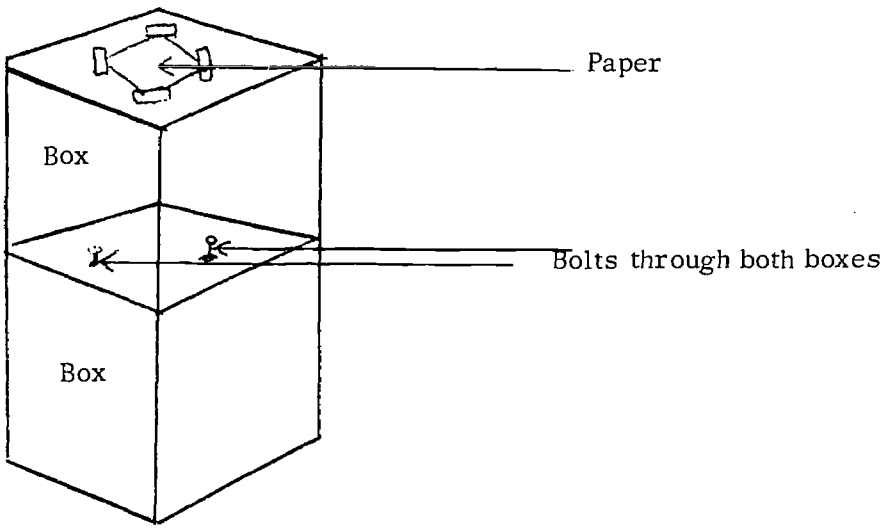
Mapping the Schoolyard

Materials:

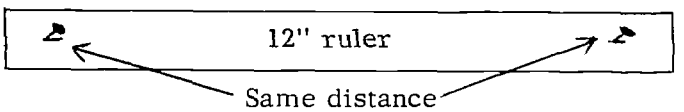
2 cardboard cartons, the ends of each having minimum dimensions of 10 X 14".
2 bolts ($\frac{1}{4}$" x 1") with which to fasten the boxes together (or nails).
1 sheet of unlined paper $8\frac{1}{2}$ X 10" minimum.
1 wooden 12" ruler.
2 tacks or brads, $\frac{1}{2}$".
scotch tape or masking tape (drafting tape).
pencil
2 stakes, one blueflagged, one redflagged.

Method of Constructing the Plane Table:

1. Place one box on top of the other on their ends, depending upon the height of the student (smaller children may want the boxes on their sides).
2. Using the bolts, fasten the boxes together.



3. Fasten the paper to the end of the box, using the scotch or drafting tape.
4. Drive the brads or tacks into the ruler. Both tacks must be equidistant from one edge of the ruler.



These will be used as sighting guides during the mapping phase.

5. The plane table is now ready.

Field Mapping with the Plane Table

Organization for Mapping

1. Two students will work together--one mapping, the other steadying the equipment.

Method of Mapping

1. The size of the area to be mapped determines the scale of the map. Given an:
   8" wide paper at scale 1" - 100' will map a space 800' wide
   " " " " " " - 40' will map a space 320' wide
   " " " " " " - 20' will map a space 160' wide.
   (Since we are using standard rulers having inches and 1/4 inches, the scale is best divisible by 4'. Thus, if 1" - 40' then 1/4" = 10'. If 1" = 20' then 1/4" = 5'. If 80', then 1/4" = 20'.
   This must be determined by observation and estimate, or by actually measuring the greatest distance between two objects to be included on the map.
   Having decided upon a scale, now we must establish our base line. Drive in the redflagged stake at the base of the boxes. Then pace across the longest distance that must be mapped and drive in another stake. The distance between these two stakes will be the only measurement needed.
   Orient your map in the direction of this line. Draw this line on your map and place an "X" at each point. Label the location of your present point "Point 1." Label the far one "Point 2."

2. Lay the ruler so that one edge is along these points. Moving (turning) your box, line up the tacks or sight along the tacks from your present position to Point 2. This establishes your base line on the map. The map must continue to be aligned with this base line during all future mapping.
   The theory behind using the plane table is to locate points by intersecting lines. This we now proceed to do.

Measuring Distances by Triangulation*

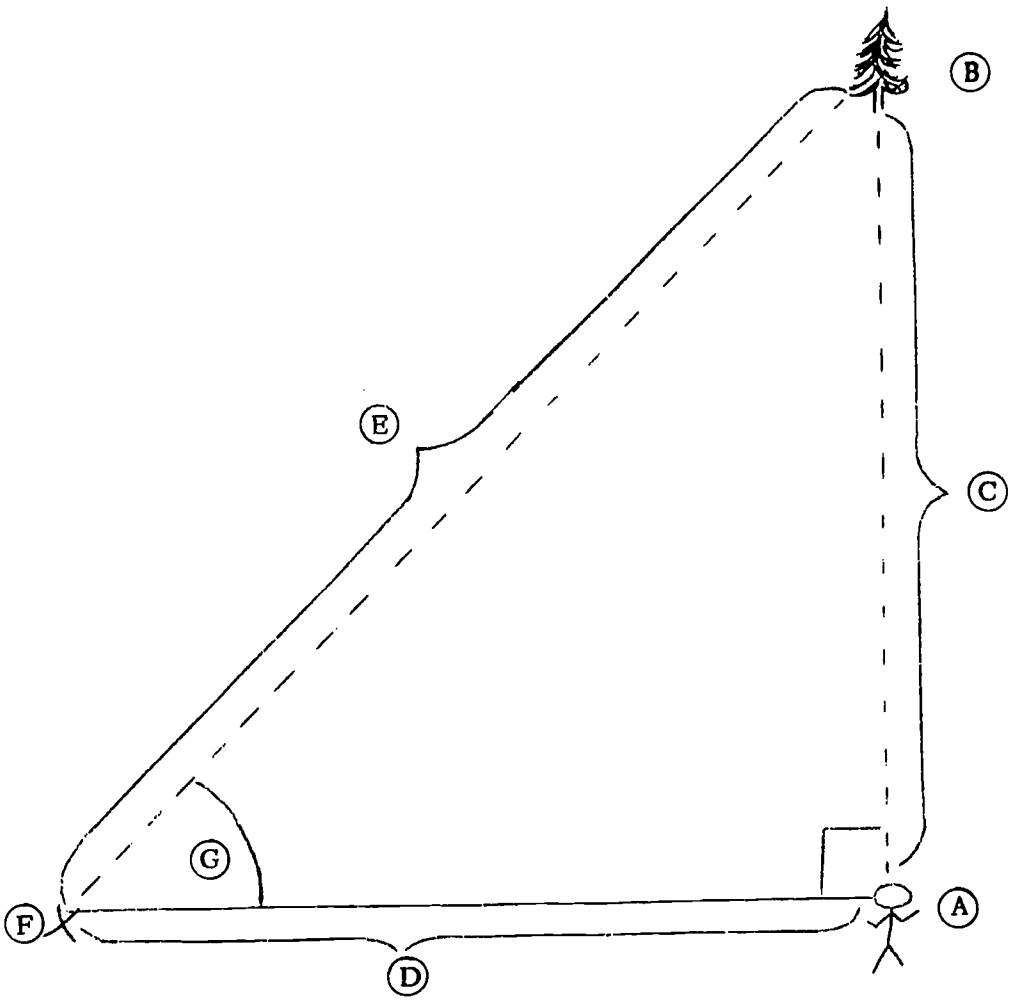
The sole purpose of this activity is to use simple triangulation to find out how far it is to a distant object.

1. Select a distant object (B) . An imaginary line (C) extends from you (A) to the object and is called the line of sight.
2. You will need a base line (D) which extends from you (A) at right angles to the line of sight. Its length must be known. See Possible Scales, this chapter.
3. You then establish a second line of sight (E) from point (F) to the object (B) .
4. A piece of paper is needed at point (A) and (F) . The line of sight (C) and the base line (D) are laid out as a right angle on both sheets. Point (A) on the paper should be directly over Point (A) on the ground. Point (F) on the other paper will be directly over Point (F) on the ground.
5. Angle (G) is calculated by a protractor and a line of the correct angle is drawn from Point (F) to the object (B) . Line of sight (E) and (C) cross at the distant object.
6. Line (C) from Point (A) to Point (B) is measured by a ruler and the inches converted to feet according to the scale being used.
   For a large area 1 inch equals many feet or yards; for a small area 1 inch equals fewer feet or yards. Suggested scale:

   1" = 100' , 1/2" = 50' , 1/4" = 25'
   1" = 80' , 1/2" = 40' , 1/4" = 20'
   1" = 40' , 1/2" = 20' , 1/4" = 10'
   1" = 20' , 1/2" = 10' , 1/4" = 5'

   Since you use rulers to measure, a scale divisible by 4 is best. 8 is also all right but it may make calculations slightly more involved.

*See next page for diagram.



Measuring Distances by Triangulation

A History of Camp Casey

Location

Camp Casey is the name given to a branch campus of Seattle Pacific College, consisting of approximately 100 acres and more than two dozen buildings located on the west side of Whidbey Island. It, and the adjacent 115-acre State Park are both a part of what was Fort Casey, one of the three forts set up years ago to protect Admiralty Inlet, the entrance to Puget Sound from the Strait of Juan De Fuca.

Camp Casey is reached by auto traveling to Mukilteo. Here one ferries a short distance across to Columbia Beach on Whidbey Island. From Columbia Beach one travels on the Main Island highway north about 23 miles, turning left at the sign "Keystone Ferry" and then about 3 miles to the Camp. Camp Casey can be reached from the north without ferry through Mt. Vernon and over the Deception Pass Bridge.

Development of a Harbor Defense Plan for Puget Sound

Soon after the close of the Mexican War, the United States took steps to provide for the military protection of the immense new territory which had been acquired in the West as a result of that conflict and the Oregon Treaty of 1846. On November 30, 1848, a joint commission of Navy and Corps of Engineers Officers appointed by the President was instructed to make an examination of the Pacific Coast with a view to determining which points were most suitable for defense purposes. Its report was not issued until November 1, 1850. Only three defensive works were recommended for immediate construction--at San Francisco, at San Diego, and at the mouth of the Columbia River. Suggested fortifications at Puget Sound, including one on the western side of the entrance to Admiralty Inlet, were relegated to the "third class," those to be built at a remote period.

The War Department and its principal officers on the Pacific Coast, however, were not inclined to share this somewhat dim view concerning the need for military defenses north of the Columbia. During August 1849, Company M., First Artillery, had been posted at Steilacoom near the southern end of Puget Sound. A short time later, General Smith, commanding the Army's Division of the Pacific, made a tour of inspection in the Pacific Northwest and came away much impressed with the need for adequate protection in the Puget Sound Region.

"There are probably few harbors anywhere superior to those on the waters of Admiralty Inlet, whether for naval or commercial purposes," he reported to the War

Department on October 7, 1849. "The entrance to the inlet," he continued, "and the islands shielding the harbors outside of it, will require strong and defensive fortifications." He stated his intention of marking out and reserving sites for fortifications at the mouth of the Columbia and on Puget Sound, and in the list of batteries he recommended for immediate construction along the Pacific Coast was one at the entrance to Admiralty Inlet.

The entire matter of a fortification plan for the Pacific Coast was soon referred to another special board of engineers, but appropriations for such work were meager, and years passed without any definite steps being taken to provide harbor defenses in the Puget Sound area except for the reservation of several tracts of public land for military purposes.

In 1855 Captain Stoneman was dispatched to inspect possible fort sites in the Puget Sound area. When he returned, he stated the real key to the protection of the Northwest Coast was British-held Vancouver Island. It is known that other officers, then and later, shared this belief that the best way to protect the Pacific Northwest was to oust the English from British Columbia.

On February 19, 1852, the Oregon Territorial Legislature memorialized Congress to send additional troops to the Northwest, "especially" to Puget Sound. This petition was but the first of a long series which followed in subsequent years, and after the Indian troubles of 1855 these requests received some attention.

During the late 1850's, with the growing tension between the United States and Great Britain over ownership of the San Juan Islands, Congress began to show more interest in fortifying the Northwest Coast. On December 23, 1858, a resolution was passed calling upon the Secretary of War for detailed plans for the defense of Puget Sound. He asked Congress for an appropriation of $10,000 for the purpose of further surveys. Congress did not agree and the matter was tabled.

When it appeared that actual hostilities might break out on San Juan Island during 1859, both Great Britain and the United States rushed troops to the scene. The American encampment, known as Camp San Juan, was maintained as a fortified post until 1874, but it was never intended as a harbor defense installation.

This flurry of excitement brought a renewal of pleas for proper protection of the Puget Sound region. On July 19, 1859, for example, Brigadier General William S. Harney, commanding the Department of Oregon, pointed out to the War Department that the United States had neither a warship nor a gun larger than a 6-pounder in the

entire Northwest, and he urged "speedy action" for the establishment of permanent works at the mouth of the Columbia and on Puget Sound.

The Corps of Engineers pushed this same request, and special War Department reports were presented to Congress recommending appropriations of $100,000 for the beginning of fortifications. No money was appropriated, however, and the appeals were renewed in 1860. Colonel George Wright, then in charge of the Army's Department of Oregon, made a particularly impassioned plea on September 20 of that year. He pointed out that the entire coast of Puget Sound and its flourishing towns, as well as the settlements along the lower Columbia, were all "at the mercy of a single hostile steamer," a state of affairs which demanded the immediate and serious consideration of the government. This argument had no immediate effect in loosening the Congressional purse strings. Evidently, however, the fears of a clash with Great Britain were responsible for another event which was to have considerable effect upon the plans for military fortifications in the Puget Sound area. On November 9, 1859, the Secretary of War ordered the Chief of Engineers, the much-respected General Totten, to make a personal inspection of the Pacific Coast to select sites for military and naval installations and to indicate the character and extent of the fortifications required for proper defense. General Totten's observations concerning Puget Sound defenses, contained in his report of May 28, 1860, dominated official War Department thinking on the subject for a number of years thereafter.

Totten, like many other officers of the time, was really impressed with relative strength of the British naval force based on Vancouver Island as compared with the small American squadron stationed on the Pacific Coast. In case of a conflict, he anticipated that the United States would be on the defensive in the Northwest. Therefore, in his recommendations he placed much emphasis upon the creation of two heavily fortified harbors of refuge upon Juan De Fuca Strait in which American naval and commercial vessels could scurry to safety when threatened by British cruisers.

The Chief of Engineers was not impressed by the settlements on Puget Sound. In his opinion there was not a single town inside Cape Flattery which would merit as much provision for defense as would even a "second class" fortification. He did agree, however, that collectively these points would be worth defending, though the cost would be "out of proportion to the value of them." And he believed that the extent of waters inside the Admiralty Inlet was so great as "even now" to justify "a large and prompt expenditure" for a single line of defense which would protect them all. Totten recom-

mended that Puget Sound be defended by a system of fortifications along a more interior line in the Foulweather Point vicinity, supplemented by works at the entrance to Hood Canal and at the "Narrows" near Tacoma.

Congress showed no more disposition to act upon these proposals than it had upon those presented earlier. During the Civil War, not much was heard nationally about protecting Puget Sound, although it was during this period that the construction of defenses at the mouth of the Columbia was actually commenced. And local commanders continued to give attention to the problem and to send out engineers to inspect possible fort sites.

One of these officers, Captain George Elliott, expressed a thought which was to be echoed many times in later years and which was to exert considerable influence upon Puget Sound defense plans. The United States had for several years been intending to locate a navy yard in the Northwest and Elliot, in 1864, recommended that no forts be built on the sound until the location of this naval depot had been definitely selected.

Upon the conclusion of the Civil War, the military officials in Washington once more expressed active interest in fortifying Puget Sound. In September 1865, the Chief of Engineers asked the Secretary of War to have twenty-four potential fort sites in that area reserved for military use by Presidential action.

After considerable delay and, evidently, after some modification, the proposal to protect the public interest in potential fortification sites was adopted. By Executive Order dated September 22, 1866, twenty-five tracts of land in Washington Territory were reserved for military purposes, among them being one of 640 acres at Admiralty Head.

The principal stumbling block in the way of a fortification plan for the northwestern waters was removed in 1891 when the United States established the Puget Sound Navy Yard, at Bremerton, in the Port Orchard vicinity, deep within Puget Sound. As one student of Washington military history has stated, had it not been for this event the Sound probably would have gone for years without adequate protection despite the protests of citizens, the efforts of Congressmen, and the recommendations of the generals, because the plan of defense eventually drawn up "was one for the defense of the Navy Yard."

Finally, in 1894, the Board made its decision. Eleven points on the Sound were selected as being suitable for the construction of coastal defense installations. Among these was Admiralty Head.

It is sometimes stated, in local histories and newspaper accounts, that mounting tension between the United States and Spain over conditions in Cuba were responsible for actual construction of the Puget Sound fortifications. It was urged that fortifications on Puget Sound would be important not only as a defense against "foreign aggression," but also as an available source of troops for the suppression of internal disorders in the region--a reference to the series of strikes and riots which had marked labor relations in Washington during the previous decade. At any rate, by act of June 6, 1896, Congress authorized the Secretary of War to expend funds for the construction of emplacements on Point Wilson, Narrowstone Point, and Admiralty Head. Strong defensive works at these three locations would present "a fairly successful obstacle to the forcible entrance of hostile ships," and thus the entire Sound would be "comparatively secure."

Acquisition of Military Reservation of Admiralty Head

As far as Admiralty Head was concerned, the Executive Order of September 22, 1866, reserving a tract of 640 acres for military purposes, had been without effect, since most of the property had already passed from the public domain into private ownership through valid donation claims. This situation had been known to the Army for a number of years, and various officers had repeatedly urged that the necessary fortification site be purchased before speculation or increased settlement should raise the price. No action had been taken, however, and thus the War Department found itself without any land upon which to build the emplacements authorized by the act of 1896. In this act, Congress authorized the Secretary of War to expend funds for the construction of emplacements on Admiralty Head.

Officers sent out to acquire the needed property early turned their attention to the Government lighthouse reserve of 10 acres already existing at or near the tip of Admiralty Head. As has been seen, it was found that an act of Congress would be necessary before the tract could be transferred from the Treasury Department to the War Department, and therefore the actual addition of this property to the military reservation was delayed until 1899. However, the Army Engineers began to treat this land as if they already controlled it as early as 1896, and construction was commenced on part of the tract during the next year.

On April 20, 1897, the United States purchased a tract containing 123 acres more or less. The price paid was $7,200. This tract formed the basic reservation for the military post which was later named Fort Casey. An additional tract, containing about 27 acres, was purchased January 18, 1899.

These three tracts, totaling 157.36 acres as finally surveyed, constituted the lands acquired in fee by the United States within the Fort Casey Military Reservation prior to January 1, 1900. On February 16, 1899, the State of Washington granted to the United States the use of the tidelands on the shores of Admiralty Inlet and Admiralty Bay adjoining these tracts, with the provision that such use should revert to the State whenever the Government should discontinue holding the abutting uplands for certain public purposes.

Plans for the development of military installations on Admiralty Head were expanded several times, subsequent to the beginning of construction in 1897, necessitating the acquisition of additional tracts of land beyond the three purchased prior to January 1, 1900.

In 1901, the United States acquired by condemnation two tracts of land containing a total of 221.55 acres. The price paid was $16,000. This extensive property adjoined the original reservation tract on the north and included a long stretch of shoreline along Admiralty Inlet and a considerable tract north of Crockett Lake.

As Fort Casey began to expand, an adequate water supply became a pressing need. On October 26, 1904, an ample supply of good water was assured by the purchase, for $3,000, of a tract containing 30.88 acres.

A triangular tract of land, containing 4.35 acres, was purchased on March 2, 1907, for $652.05. On August 29, 1908, another 79 acres was purchased. the price was $12,000. Still another tract of Admiralty Inlet at the north end of the reservation was acquired during the fall of 1909. This property contained 8.12 acres and purchase price was $1,700.

In connection with the fire-control system of the Fort Casey gun batteries it became necessary to obtain land lying on the low shore of Admiralty Bay some distance to the east of the main reservation. Two more tracts of land were obtained. One of these containing 10.85 acres was obtained June 3, 1907. The other containing 12.11 acres was acquired by condemnation on November 1, 1909.

Initial Construction Period, 1897 to 1899.

Scarcely two months after Congress, by the act of June 6, 1896, authorized the construction of batteries to guard the entrance to Admiralty Inlet, Army Engineers were actually at work on Admiralty Head, making topographical studies and beginning to prepare plans for the emplacements. But no ground could actually be turned until after April 20, 1897, when the purchase of the main portion of Admiralty Head was completed. The Corps of Engineers was later to complain that the failure to obtain this site "as early as desired" had seriously delayed the progress of construction work.

The award of a contract to the firm of Maney, Goerig and Rydstrom of Everett, for the construction of concrete emplacements for four 10-inch guns on disappearing carriages, was approved by the Chief of Engineers on August 13, 1897, and by the end of that month work was actually under way. The contract called for the moving of 40,000 cubic yards of earth on the bluff back of the lighthouse, and to perform this task a crew of about eighty laborers was recruited. The rate of pay was $1.65 for a ten-hour day. When the man learned that they were required to board at the contractor's cook house at a weekly cost of $4.50 for meals, they went on strike.

The company sought in vain for a new crew throughout the entire Puget Sound Area and was finally forced to settle the dispute by agreeing to pay the workmen $2 a day.

This work stoppage, together with the fact that the first cargo of cement received at the site was rejected by the inspectors, caused the construction to proceed more slowly than required by the contract. The four emplacements were not completed until December 15, 1898. The installation of the lighting system and the mounting of the carriages and guns required additional time.

On November 16, 1897, the Chief of Engineers approved plans for a battery of sixteen 12-inch mortars on Admiralty Head. A contract for the required emplacements was made with Maney, Goering and Rydstrom on February 28, 1898, and work was started during April. These emplacements were located on the eastern slope of the point. They were arranged in four deep pits, each designed to accommodate four guns. The mortar emplacements were completed on March 14, 1899, and all the carriages were mounted prior to the end of the fiscal year.

By June 30, 1899, plans had been completed for the construction of emplacements for two 5-inch rapid fire guns on balanced pillar mounts at the new reservation. However, no work had been started by that date.

During the first period of construction, several buildings were erected on the reservation in connection with the work. The Army engineers supervising the project converted the old Kellogg cabin into an office. Two other structures were erected nearby as quarters.

Establishment of Fort Casey

The new reservation and batteries on Admiralty Head were officially named "Fort Casey" in honor of General Thomas Lincoln Casey, last Chief of Engineers, United States Army. General Casey, who had died on March 25, 1896, was remembered according to newspaper publicity of the time, as one of the "best-known and best-loved" officers of the War Department. A native of Sackett's Harbor, New York, he graduated from the United States Military Academy in 1852. During his long career in the Corps of Engineers, he supervised the construction of many well-known projects, but he is best remembered for his work in Washington, D. C. and its vicinity. Under his immediate personal direction such major undertaking as the Potomac Aquaduct, the Washington Monument, and the Library of Congress Building were completed. He also directed the construction of the State, War, and the Navy Building.

Records available for the present investigation do not reveal when Fort Casey was officially activated as a military post. One source says it was "established" in 1898; another gives the date as February, 1900.

At any rate, it is known that a small detail arrived on the reservation shortly after the completion of the gun emplacements. It has been stated that this first garrison numbered thirty men under the command of Lt. A. D. Putnam. They lived in tents until a frame barracks for sixteen men and a single set of officers' quarters were completed on February 22, 1900.

The mounting of the guns in the completed batteries was accomplished by January 26, 1900. The first test firing was performed on September 11, 1901.

Admiralty Head Light Station

In exchange for the original lighthouse reserve, the acting Secretary of War, by letter dated July 31, 1899, transferred two tracts of land on Admiralty Head to the Treasury Department for lighthouse purposes. These parcels, having a total area of about 2.58 acres, were part of the basic reservation tract acquired by the Army on the shore of Admiralty Inlet adjacent to the north boundary of the basic reservation tract. Later it developed that this location was not the most suitable site for a lighthouse. On January 23, 1902, this land was exchanged for another tract of similar size.

Plans and specifications for a new Admiralty Head Light Station were completed by the 13th Light House District Office in Portland, Oregon, during July, 1901. Construction was begun shortly thereafter.

The new lighthouse was quite an elaborate structure. Its circular brick tower, about 25 feet high, was connected with a sturdy, two-story brick-keeper's quarters. Other improvements and outbuildings on the lighthouse tracts included a frame barn, a frame chicken house, and a brick or concrete paint and oil house.

Due to improvements in aids in navigation, the Admiralty Head Ligh Station lost its importance in later years. On January 17, 1941, the Secretary of War asked the Treasury Department to report the station as surplus "with a view to its transfer to the War Department for use in connection with military training activities." The Treasury Department was agreeable, and on February 10, 1941, this together with improvements thereon was declared surplus to the needs of the Coast Guard. In March 1941, the Public Buildings Administration entrusted the custody of the Station to the War Department, subject to the condition that should need for a navigational aid at this point develop in the future, suitable land would be made available to meet the requirements of the Coast Guard.

The lighthouse building itself was adapted by the Army for military purposes. At some period prior to 1950, it is known to have been used for the K-9, or dog training program. The structure still stands but it has been severely damaged by neglect and vandalism.

Development of Fort Casey, 1900-1917

At the time the fortification of the entrance to Admiralty Inlet was authorized in 1896, it evidently was not the plan to make provision for large garrisons on Admiralty Head and Point Wilson. Seemingly the plan was to maintain an "efficient garrison" at centrally located Marrowstone Point from which troops could be sent to the other two forts as occasion demanded. Quarters at these latter points were to be limited to those necessary to house the small detachments required to guard and maintain the batteries.

Not long after the outbreak of the Spanish-American War in 1898, however, evidence becomes abundant that these plans had been changed and were intended to develop Fort Casey into a formidably armed installation manned by a large and permanent garrison. It has been stated that this reversal of policy resulted from the sinking of the MAINE. Previous to that event, there had been a good deal of political jockeying by localities along the Sound, each trying to win for itself a major Army post. The result, according to one student, was "red tape and opposition in high places," which caused construction on the Admiralty Inlet batteries to "proceed at a snail's pace"; but the prospect of a Spanish bombardment sent forth a "united Macedonian cry for protection that could no longer be ignored at the nation's capitol."

Be this as it may, development of Fort Casey went ahead with a rush after 1899. By January of the next year, the emplacements for the two-gun battery of 5-inch rapid fire guns (the present Battery Turman) had been completed and, by about the same time, plans had been made to add three more emplacements to the existing main battery of four 10-inch rifles. Additional lands were acquired by condemnation in 1901.

On February 20, 1902, the commanding general of the Department of the Columbia appointed another board to fix the locations of the buildings of the enlarged post made possible by this additional land. The recommendations of this board constituted the basic plan of Fort Casey during the remainder of its existence as a military post. The board laid out a parade ground occupying most of the low level land at the neck of Admiralty Head. Along the south edge of this parade ground a row of barracks, with auxiliary structures, was planned. Quarters for the post commander and other officers were projected low on the slope at the north end of the neck. The wharf, built during the first construction period, was to be rebuilt and enlarged.

Before these new buildings were commenced, Fort Casey's first regular garrison arrived. It was composed of 6 officers and 200 enlisted men of the 63rd and 71st Companies of Coast Artillery. Newspaper announcements of the event stated that the new troops were scheduled to arrive in Seattle from Alcatraz Island, in San Francisco Bay, on July 20, 1902, and that they would be sent on to Fort Casey by special steamer.

Another event of some importance in the history of Fort Casey occurred on or about October 17, 1903, when wireless communication "by dots and dashes" was established with Fort Townsend, on Point Wilson across Admiralty Inlet. General New sent a message to President Theodore Roosevelt announcing that "Fort Casey, heretofore without means of communication with the mainland, is now and in the future will be in touch with all points of our great country, through the system of the Pacific Wireless

Telegraph Co." The newspapers hailed this event as the opening of the "first wireless system in the Northwest." It is interesting to note, however, that a year later regular submarine communication cables were laid between Forts Worden, Flagler, and Casey.

At the time of its establishment as an active military installation, Fort Casey was a subordinate post of Fort Flagler, on Marrowstone Point, which was headquarters of the Puget Sound Artillery District. Several years later, the headquarters were moved to Fort Worden, where they remained until after World War II.

Evidently the first building of the expanded Fort Casey to be completed was the wharf. This structure, together with a long trestled roadway connecting it with the main part of the post. was accepted by the constructing quartermaster during August 1903. By April 25 of the next year, the greater part of the new buildings had been turned over by the contractor. These structures included barracks, commanding officers' quarters. quarters for officers and non-commissioned officers, a coal shed, and a quartermaster and commissary storehouse. Some of these buildings are still standing. They were of heavy frame construction, with slate roofs.

Development of the post did not stop here. Building records show that one or more. new structures were completed during nearly every year between 1904 and 1910. For instance, additional officers' quarters were added in 1905; a fire station, hospital rooms, blacksmith shop, quartermaster workshop, and non-commissioned officers'. quarters were completed in 1906; a gymnasium, with bowling alley, was erected in 1908, and during the next two years additional non-commission officers' quarters and various storage structures were finished. The last major accomplishment of the building program prior to World War I, was the erection of reinforced concrete power house in 1910.

During these same years the armament of Fort Casey was steadily increased. The three additional 10-inch rifles which had been planned by 1900 were installed during the next few years. The exact sequence of this construction is now clear from available records. Evidently one gun was added to the four completed by 1899, and from these five guns two batteries were formed: Battery Worth, 2 guns, and Battery Moore, 3 guns. This work may have been accomplished as early as 1899. The other two 10-inch guns were placed to the south of the earlier five and opposite the extreme tip of Admiralty Head. They formed Battery Kingsbury, which was completed in June 1904.

By June 1905, a battery of two 3-inch rapid fire guns had been completed on the eastern side of Admiralty Head near its tip. These guns, which overlooked the wharf area, comprised Battery Trevor .

Another battery of two 3-inch rapid fire guns, named Battery Van Horne, was installed on the low bluff fronting Admiralty Inlet near the southwest corner of the parade ground. This work also had been completed by June 1905.

In August 1905, a battery of two 6-inch rifles on disappearing mounts was completed on the coastal bluff north of the parade ground. These emplacements were named Battery Parker.

The last battery of coast artillery to be installed at Fort Casey was Battery Valleau, situated near the southern tip of Admiralty Head between Batteries Kingsbury and Trevor. It consisted of four 6-inch rifles on disappearing mounts and was completed in March 1907. The following is a list of batteries, with details as to armament:

Battery Thomas Parker. Two 6-inch rifles, disappearing carriages. Completed August 1905. Armanent evidently removed prior to 1944, probably prior to March 1, 1933.

Battery Isaac Van Horne. Two 3-inch rapid fire guns on pedestal mounts. Completed June 1905. Effective range 6,600 yards, extreme range 10,960 yards. Guns were still in place in 1945.

Battery Reuben Turman. Two 5-inch rapid fire guns on balanced pillar mounts. Completed January 1900. Armament removed, evidently prior to March 1933.

Battery William Worth. Two 10-inch rifles, disappearing carriages. Completed 1898. Guns and carriages scrapped 1943.

Battery James Moore. Three 10-inch rifles, disappearing carriages. Completed 1899. Scrapped, 1943.

Battery Henry Kingsbury. Two 10-inch rifles, disappearing carriages. Completed June 1904. Gun No. 1 removed, 1918; Gun No. 2 and carriage scrapped in 1942 or 1943.

Battery John Valleau. Four 6-inch rifles, disappearing carriages. Completed 1907. Armament removed prior to 1944, probably prior to March 1, 1933.

Battery John Trevor. Two 2-inch rapid fire guns on pedestal mounts. Completed June 1905. Gun tubes removed November 16, 1933; carriages scrapped in 1943.

Battery Alexander Schenck. Eight 12-inch mortars. Completed in 1899. Plotting rooms constructed in 1914. Power House "B" constructed in 1919. Guns and carriages removed in 1943.

Battery Seymour. Eight 12-inch mortars. Completed 1899. The two forward guns and carriages in each pit were removed in 1921; the four remaining guns and carriages were removed in 1943.

Fort Casey during World War I

In common with other coast defense posts in the west, Fort Casey was the scene of increased military activity during the first World War. Available records throw little light upon events at the post during this period, but there were some clues to indicate the trend. For instance, a map of 1915 shows a single row of ten tents of temporary quarters in the cantonment area on the top of the hill west of the mortar batteries, whereas a map dated 1919 reveals that the number of these structures had by that time increased to thirty. On the other hand, it was evidently during this same period that several of the batteries were disarmed.

The Silent Years, 1918-1940

During the first two or three years following the war, the Army evidently had every intention of maintaining Fort Casey as an active and strongly garrisoned post. In 1920, for instance, plans were made to install two anti-aircraft batteries in the northern section of the reservation. Evidently, these batteries were actually constructed, although the dates of completion are now known. The First Aerial Battery, designed for two 3-inch, fixed anti-aircraft guns, was located near the extreme north boundary of the reservation. The second Aerial Battery was north of Crockett Lake. It was designed for three of the same type of guns but evidently mounted only two.

There was a mild flurry of construction during 1920 and 1921. A filter house and storehouse were built at this time.

Then the Army entered one of its periods of austerity, and Fort Casey was placed upon what amounted to a "caretaker" status. Only a small force, at one time amounting to a single platoon under a sergeant, was kept at the post to guard and maintain the property. For about twenty years the broad parade ground "lay virtually untrod," and Fort Casey assumed an "air of desolation."

Practically the only excitement to occur during this period was occasioned by the arrest of two men in 1938 for stealing lead from the counterweights of the Fort Casey batteries.

Fort Casey during World War II

As the nation began to increase its military strength under threat of involvement in the European conflict which began in 1939, Fort Casey once more came to play an active role in the country's system of defenses. With the calling of National Guard units into service and flow of selectees into the ranks, the Army developed plans for the accommodation and training of these men. Fort Casey entered into these plans.

At the end of 1940, Fort Casey was a unit in the military command known as Harbor Defenses of Puget Sound. Fort Worden was the headquarters and largest post in this command. The other units, in addition to Fort Casey, were Fort Flagler and Fort Whitman, the latter an ungarrisoned post near Deception Pass.

In April, 1941, the Harbor Defenses of Puget Sound were garrisoned by two military units; the 14th Coast Artillery Regiment, of the regular Army, and the 248th Coast Artillery Regiment, composed of former National Guard units. Colonel Cunningham was in command.

During 1940 an allotment of $307,082 was made for new construction at Forts Casey and Flagler. That fall the post constructing quartermaster prepared plans for the expansion of troop accommodations at Fort Casey, and work began during the winter. In February and March, 1941, twenty-four new buildings were completed, most of them located along the south edge of the parade ground in the area once occupied by the barracks built at the turn of the century. These latter structures, damaged by decades of neglect, had been demolished. The new facilities including nine barracks, a mess hall, post exchange, company store, theatre, water reservoir, hostess house, company recreation hall, administration building, guardhouse, infirmary, storehouse, and water reservoir. The buildings were nearly all of temporary frame construction.

Fort Casey quickly lost the "ghost town" appearance which had characterized it as late as January 1941, when a single platoon under a sergeant made up the garrison. By February, selectees from the Middle West were enroute to fill out the 14th Coast Artillery to war strength. The 1st Batallion of the regiment was assigned to garrison Fort Casey during March, and by June there were 400 men at the post.

Military activities at Fort Casey during the war consisted largely of training and routine garrison and guard duty. A number of the remaining outmoded coast defense guns were salvaged for scrap purposes in 1942 and 1943.

The only major new armament installation at Fort Casey during the war years was Battery A-A No. 1, completed June 14, 1943. This battery consisted of three 3-inch anti-aircraft guns located as follows:

Gun A-A No. 1 in the former Gun Pit No. 3 (southernmost emplacement), Battery Moore

Gun A-A No. 2 in the former (west) Gun Pit No. 1, Battery Kingsbury

Gun A-A No. 3 in the former (east) Gun Pit No. 2, Battery Kingsbury

Other, lesser installations, such as the radio locator shelter built in 1941, were made to strenghen and modernize Fort Casey's defense.

Last Years as a Military Post 1945-1954

For five years after the end of the war, the Army maintained Fort Casey as an active military post, in the position of a "satellite facility" of Fort Worden. Evidently one of its major uses was for training engineer and other troops. For instance, during the early months of 1950, the 56th Amphibious Tank and Tractor Battalion of 600 men was undergoing instruction on the reservation.

On April 17, 1950, however, the Army announced that the 56th Battalion was being transferred to Fort Flagler and that Fort Casey was being placed in caretaker status. The reasons given were a need for economy and a lack of training facilities at Admiralty Head.

Shortly thereafter, Fort Casey was placed in the custody of the District Engineer, Seattle District, Corps of Engineers, and there its administration remained for the next four years at a monthly custodial cost of about $1,150. In April, 1954, this property was turned over to the General Services Administration. The property thus turned over by the Department of Defense to the General Services Administration included 123 buildings and other structures which had cost the United States approximately $1,497,300. The land had been acquired at a cost of $41,848.28.

Fort Casey Military Reservation as Surplus Property, 1954

In accordance with the procedures established by law for the disposal of surplus real property, the General Services Administration circularized other Federal departments and agencies to ascertain if there existed any other Federal need for the property at Fort Casey declared surplus to the requirements of the Army. On May 14, 1954, the Coast Guard requested custody of approximately 0.5 acres at the extreme southern tip of Admiralty Head in view of the "future possible requirement for the establishment of an aid to navigation" at that point.

Therefore, on July 1, 1954, the Commissioner of Public Buildings determined the property, except for the half acre requested by the Coast Guard, to be surplus to the needs and responsibilities of the Federal Government. On July 28, 1954, the Coast Guard indicated that it had reconsidered its requirements at Admiralty Head and had determined that 1.7 acres would be necessary instead of the 0.5 acres originally requested. Subject to this and several other minor adjustments, the property was put up for disposal by the General Services Administration.

Seattle Pacific College obtained a portion of the government reservation, for definite educational purposes, in February 1956.

Present Facilities of Camp Casey

At the present, Camp Casey includes nine 2-story dormitories with 60 single beds each, a clubhouse fully equipped for cooking, feeding, and sleeping a group of 18-22, a fully equipped heavy-duty electric kitchen, a cafeteria seating approximately 200, a gymnasium, an auditorium seating approximately 300, an Olympic size outdoor swimming pool, an administration building, a staff lounge and first aid center, a large warehouse, and several other buildings. The buildings are provided with oil heat and modern facilities. The entire camp includes about 30 acres of level playfield and nearly one quarter of a mile of beach, about 40 acres of timbered land also bordering on the water but with a high bluff, and about 25 acres east of the county road bordering former Crockett Lake, and a portion of the old lake bed itself.

The entire installation with adjacent State Park and other nearby beaches makes this a most attractive camp for outdoor education, teaching conservation, items of historic interest, magnificent scenery, study of fresh and salt water marine life, land erosion, fishing, and just plain recreation, relaxation, and rest. Two historic blockhouses are nearby. The landing for Keystone Ferry and Port Townsend is less than a mile away. A large abandoned lighthouse, now a State museum, is only a short distance from the Camp. The Camp also includes the intriguing old emplacements for two 6-inch disappearing coastal defense guns. Other large gun and mortar emplacements are in the State Park.

Historical Summary of U.S. Naval Air Station, Whidbey Island, Oak Harbor, Washington

On the 17th of January, 1941, almost eleven months before the United States entered World War II, the Chief of Naval Operations asked the Commandant of the Thirteenth Naval District to recommend a site in the Pacific Northwest for the rearming and refueling of Navy patrol planes. The answer to this request was originated by the Commanding Officer of the Naval Air Station, Seattle, who recommended the sites on the northern part of Whidbey Island, in Puget Sound, which are now occupied by the Seaplane Base and Ault Field.

On August 14th. the same year, surveyors began work on the proposed station. On September 9th, an initial appropriation of $3,790,000 was set aside for the "Re-arming Base, Whidbey Island."

Construction work began on January 15, 1942, and on September 21, 1942, the Station, already renamed "U.S. Naval Air Station, Whidbey Island, Washington," was placed in commission. The airfield itself at the Naval Air Station Whidbey Island was named Ault Field in honor of Commander William Bowen Ault, U.S.N., who lost his life on May 8, 1942, in the Battle of the Coral Sea. Commander Ault led his squadron in a particularly aggressive attack on a Japanese aircraft carrier and disappeared after radioing that he had been hit and was making a water landing. From the time of the commissioning until 1949 the Station was considered a temporary establishment.

As was anticipated, the site chosen for this station proved advantageous in several ways. The area was rural, rather than urban, allowing room for spacious grounds and long runways without numerous problems involving prior occupants. Also largely absent was the problem of noise-abatement which becomes critical in heavily populated areas. Also, there was room for expansion without prohibitive cost to the Government or mass dislocation of established property holders.

Whidbey Island, lying in the "rain shadow" of the Olympic mountain range, had much less rainfall and a great deal more good flying weather than many other areas in the Puget Sound Area. Also, the site of the Naval Air Station occupied a strategic location commanding the east end of the Strait of Juan de Fuca, the main entrance to Puget Sound.

World War II service by Naval Air Station Whidbey Island included the re-arming and servicing of patrol planes, for which the station was created. In addition, a good deal of various other types of training went on here, among which was training in aerial rocket firing and, for a time, two weeks' basic training for recruits and additional

training for personnel aspiring to petty officer ratings. An unexpected function developed in 1942, when torpedo overhaul equipment was transferred here from Indian Island, Washington. At the start, the capacity of the torpedo shop was six torpedo overhauls per day. By January 1945, the schedule had increased to twenty-five torpedoes per day.

With the war over, the station was placed in a reduced operating status in January, 1946. However, by December of 1949, plans were begun to make Naval Air Station Whidbey Island the all-type, all-weather Navy field of the Pacific Northwest to support Fleet and Alaskan operational activities. With the onset of the Korean conflict, the pace of expansion and new construction greatly accelerated.

The most tangible evidence of the 1949 decision to make Naval Air Station Whidbey Island the primary and permanent naval air facility in the Pacific Northwest was the many new concrete buildings erected near Ault Field. Among the new, permanent structures completed and put into use were a new Operations building, a new "Miramar"-type hangar, seven new barracks buildings, and a new subsistence building (galley and mess hall). All of the new buildings mentioned were completely fireproof, reinforced concrete construction.

In the mid-1950's, at least half a dozen projects were underway or contemplated for the immediate future. More than $3,500,000 was earmarked for improvements.

On top of the list was the "Brunswick"-type hangar for which ground was broken in the fall of 1955. This structure, at a total cost in the neighborhood of $2,830,800 was scheduled to be completed by spring of 1957.

"Over-runs" were planned for two of the runways on Ault Field. These were 1,000 feet in length and 500 feet wide. Highway 1-D was rerouted to clear the way for one of the "over-run" strips.

A radar air traffic control center was completed around the middle of 1957 at a cost of $400,000.

Installed in the early summer of 1956 was a "Tacan," a tactical air navigation aid which enabled pilots to determine their exact range and distance in relation to the station.

A "TVOR"--a terminal very high frequency radio omni range, which is a navigational aid to assist pilots in their travel from one point to another and is directional so that a plane may come in from any direction, was scheduled for completion in the summer of 1956.

A $20,000 radio beacon was planned for construction on Lopez Island, one of the San Juan Island group, neighboring Whidbey Island. This would help the approach controller on duty at Ault Field in his job of assisting instrument range approaches.

By the late 1950's monetary value of the Station's land, buildings, and equipment on Whidbey Island was approximately $50,000,000. Total land area of the Station was slightly more than 5,000 acres.

Generally, five squadrons of patrol bombers are home-based at this naval air station. A group of skilled technicians, a Fleet Aviation Services Squadron, called Naval Air Station Whidbey Island their home port. The patrol squadrons based there conducted operations (or peacetime drills) in anti-submarine warfare, mine-laying, aerial photography, and supply transportation. Their periods of "stateside" training at the Station are followed by deployment for approximately six months to duty in Alaska or the Far East. Squadrons deployed from this Station have patrolled the touchy Formosa Straits almost continuously ever since the days of the Korean conflict.

Various instructional groups, with skilled personnel and special training equipment, are located both at the Seaplane Base and Ault Field to provide training in all fields of aircraft maintenance and repair, including the extremely complex field of electronics.

The number of military personnel on duty at Naval Air Station Whidbey Island fluctuates with the arrival and departure of squadrons and because of other factors, but averages approximately 1900. About 700 Civil Service workers are usually employed on the Station. The monthly payroll was quite recently computed to be approximately $700,000 with 65% of the total going to uniformed personnel, and the remainder to Civil Service workers.

A large percentage of the Navy men stationed there, as everywhere, are married. The Air Station provides Navy homes for 343 families. Civilian-owned (purchased with the aid of Title VIII or under the "Wherry Housing Act") homes are occupied by approximately 300 Navy and Civilian families. In addition, many Navy families own or rent homes among the civilian community. The population of Oak Harbor, approximately 400 before World War II, increased to 2200 by 1955. Dependents of Naval Air Station Whidbey Island personnel live in or near the neighboring towns of Coupeville, Anacortes, and Mount Vernon.

This, briefly, is the story of Naval Air Station Whidbey Island, the vigorous, still-growing defense giant of Puget Sound.

SECTION IV

SURVIVAL AND SIMPLE OUTDOOR NAVIGATION

MAIN UNDERSTANDING

In order for one to survive in the outdoors, he must have an understanding of the effect that angry weather can have on an outing. One must be prepared for the possibility of Hypothermia.

BACKGROUND INFORMATION

As outdoor living becomes an important addition to the school curriculum, the child will be exposed to an exciting world of new and valuable knowledge. He will learn about his environment and will become more appreciative of the relationships between plants and animals and how they are influenced by soil, water, minerals, air, and sunlight.

In addition to a greater appreciation for the "outdoors," the children should be challenged to prepare for the possibility of getting lost and/or being caught in a severe storm. This unit will deal with survival and bearing and will offer a number of activities to allow each child the tools necessary for his comfort and safety.

When planning for any outing in the wilderness, one must consider the possibility of foul weather which may add considerably to the complexity of the outing. Fog can obscure landmarks and can make navigation nearly impossible. Rain and snow can make travel hazardous. Trails can become slippery and streams may wash out crossings. Thunder and lightning always warrant a rapid descent from high points. In addition, weather can quickly destroy the morale of the group. And, when one gets cold outdoors, he can become careless.

Wind is one's greatest enemy because it can quickly steal his energy through loss of body heat. It draws heat away from the body through a means we call convection, one of the five means of body heat loss.

The human body has a complicated heating system which maintains a steady flow of warmth to the vital organs contained in the trunk. It derives its fuel from what we eat, drink and breathe. The body also has a cooling system which helps the heating system maintain the body at approximately 98^{o} F. in still air.

The delicate balance of heating and cooling necessary to maintain optimum body temperature can be upset by significant or prolonged changes in the temperature of the air next to the body. To maintain a layer of still air next to the body, we

must wear clothing to protect from radiation, convection, and conduction. Conduction of heat occurs when we touch anything that is cooler than our body temperature. Convection occurs, as mentioned earlier, when the wind blows warmth away from our skin. The leading cause of heat loss for the body is radiation. The head is the body's most efficient portion of the body's radiator system. So rapid is the radiation from the head in a cold, wet situation, that heat loss from an unprotected head can be enormous....So, when your feet are cold, put on your hat.

Hypothermia (Killer of the Unprepared)

The challenge is to stay alive. Hypothermia (miscalled "exposure") is caused by accidental lowering of the body temperature during wet, windy, or cold conditions. Lack of proper clothing, inadequate shelter, and energy depletion are the most common contributors to serious problems during stormy weather. (See "Four Lines of Defense Against Hypothermia.")

Survival is Keeping the Body Alive

Basic necessities of the body are: air, shelter, water, food, and the will to live. You can live approximately:

three minutes without air

three hours without body shelter under certain weather conditions of wind, wetness, cold

three days without water

3 weeks without food

No one knows how long one can live without the will to live.

Each person in the outdoors will, of course, attempt to provide for each of the above necessities. Perhaps the easiest to prepare for, and the most crucial, is the necessity for shelter (both clothing and covering). Even the very best clothing loses much of its insulation qualities when it becomes wet or the wind increases. The thermal conductivity of water (or ice) is 240 times as great as that of still air. This means that wet clothing can extract heat from your body up to 240 times as fast as dry clothing. When clothing gets wet, it no longer provides an insulating layer of warm air next to the skin. Instead, it rapidly conducts heat away from the body and dissipates it into the outer environment.

Use Wool. Wet clothing is like a wick. If a cold wind is blowing, or if the individual is not generating extra heat by strong exertion, this "wicking action" or "waterchill" will dissipate heat much more rapidly than the body can produce it. However, it is worth noting that the wicking action of wet wool is considerably less than that of other fabrics. Wool can provide some warmth EVEN WHEN WET!

Following are some activities and teaching aids that will be beneficial:

ACTIVITIES

1. Touch ice and watch the nerves turn off the flow of warm blood to the cold hand. This is caused by too much cold blood returning to the heart.

2. Demonstrate the value of wool and show the large air sacs in the weave. Show wicking action of cotton. To do so, suspend the ends of an old cotton sweatshirt sleeve and a wool sweater sleeve in a shallow container of water. Compare the amount of water absorbed by each sleeve.

3. Demonstrate the heat loss of wet wool and wet cotton. Dip both hands in water, one clad in wool and one in cotton; air dry while wearing them by swinging your hands.

4. Demonstrate the heat loss resulting from wind by using the wind or a fan to take heat from a match or fire.

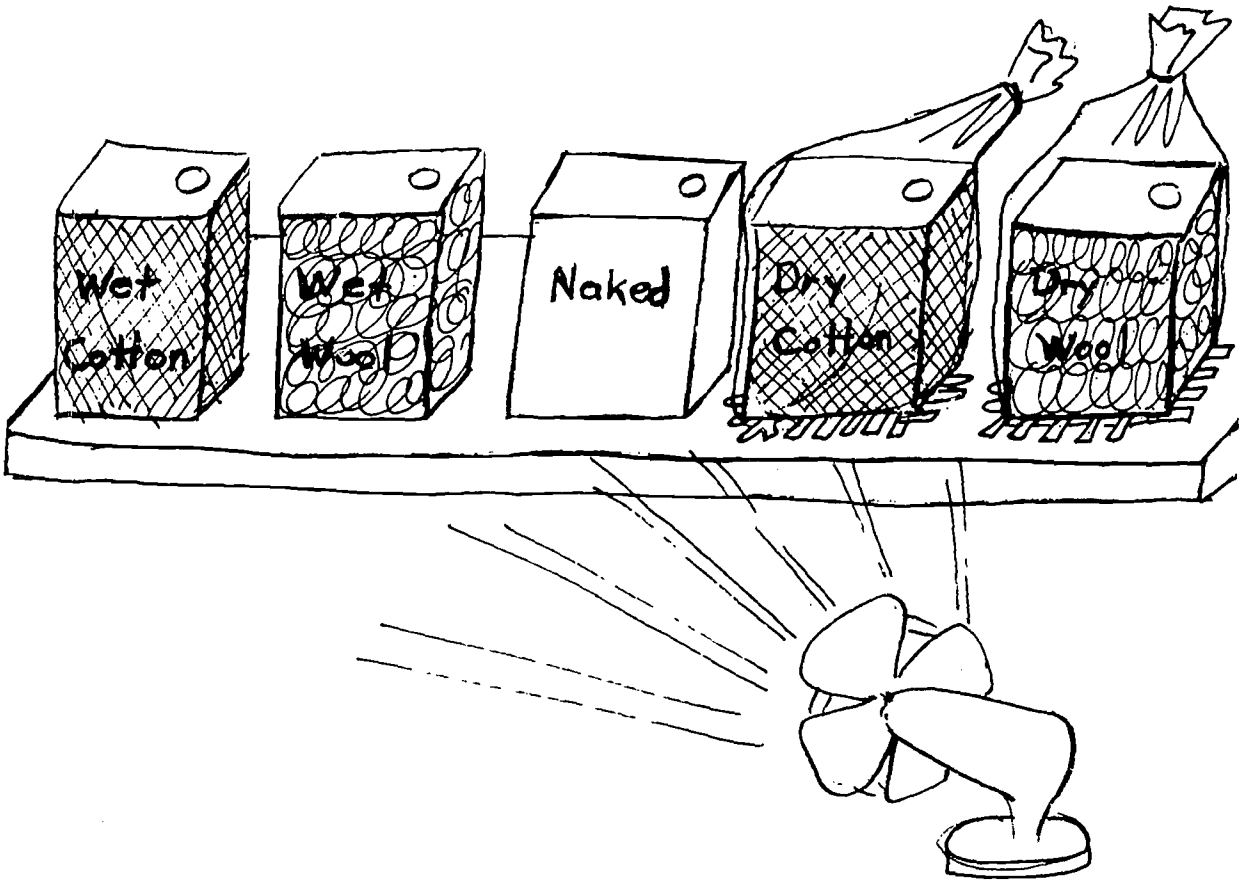
5. Hold hand out of a vehicle window for a few minutes and note the numbness that sets in from the heat loss in the hand caused by fast moving air and outside temperature.

6. Make a "Storm Kit," and explain the use for each item within the kit. (See Mountain Rescue Council, Tacoma Unit brochure at the end of this section.)

7. Demonstrate wind chill charts and discuss with students the effect cold has on one's mobility. To use the wind chill chart, place a ruler to connect the desired wind velocity in the left vertical column with the selected temperature in the right vertical column. For example, start when the temperature is 50^{o} F. and the air is moving at 2 miles per hour. It is readily determined that the chill factor at this point is a "cool," or 450. But, if we move the marker to a wind velocity of 25 miles per hour and a temperature reading of 30^{o}, the chill factor drops into the 1100 range, indicating a "bitterly cold" and a comfort level would be difficult to maintain. See "Windchill Chart" at the end of this section or page I-V of Fear, Eugene H., Outdoor Living.

8. Water Heat Loss Demonstration: Acquire five, two-gallon metal cans. Dress four of them--one in wool clothing, one in cotton (such as the common sweatshirt and jeans,) one in cotton with a plastic bag surrounding it, and one in wool with a plastic bag around it. The fifth can be left naked. Fill

all the cans with hot water all at the same temperature. Place the plastic-covered cans upon some form of ground insulator (crossed dry twigs, boughs, etc.). Place all the cans in a tray and place them either outdoors or imitate an outdoor situation by sprinkling water (rain) over the cans and allowing a fan to continually blow upon the cans. Record the temperatures after one hour. Radiation, convection and conduction will remove the heat very rapidly and simulate their effect on the human body under similar conditions.



9. Show how burrowing under an exposed log is easier than building above-ground shelter. Explore the wooded areas for possible old logs, boughs, burrows, caves, bark and slab wood with which you can demonstrate ground insulation and shelter construction. (While exploring, look for pitch for fire starting.)

10. Discuss how animals take shelter when adverse weather comes.

11. Demonstrate advantage of plastic-tube tent over sheet plastic (hands not needed to hold plastic shut--less body heat loss.)

12. Demonstrate various ground insulator: wood, limbs, dry grass, leaves, dry bark, cardboard--anything that is dry and gives a dead air space between the human body and the cold ground. (NOTE: Demonstrate the poor value of ferns by squeezing water from them.)

13. Demonstrate the value of small shelters that are easily warmed with body heat. Insist on ground insulation.

Simple Outdoor Navigation

GENERAL UNDERSTANDING

The ability to use a map and compass is a skill which can help one to appreciate the out-of-doors and to survive in emergency situations.

BACKGROUND INFORMATION

For some information on the value of being able to orient oneself in his surroundings, see Appendix VI of Eugene Fear, Outdoor Living,* and pages 1 through 4 of Bjorn Kjellstrom, Be Expert with Map and Compass.*

ACTIVITIES

1. Ask students to recount situations in which they found ways of orienting themselves in strange surroundings. List on the chalkboard some of the landmarks the children have used to find their way in both usual and unusual travels.

2. Read to the students accounts of hikers and hunters who have had to find their way out of places of distress. See the newspaper reports from the Seattle Post-Intelligencer which are to be found at the end of this section.

3. Have the students view the film Lost Hunter, Seattle Public Library.

SPECIFIC UNDERSTANDING

A map is a reduced representation of a part of the earth's surface which provides information useful in simple navigation.

BACKGROUND INFORMATION

For brief definitions of terms, symbols, and explanations of map-use, see pages 2-4 of Appendix VI, Outdoor Living and pages 5-50 in Be Expert with Map and Compass, and pages 12-14 of Margaret Milliken's, et al., Field Study Manual for Outdoor Learning.*

ACTIVITIES

1. A map and an aerial photograph of the same geographical region can be examined by the students to find how each show detail and relative position of landmarks. Road maps of Western Washington from service stations may be useful for comparison with aerial photographs of the Puget Sound region. See page 10, Be Expert with Map and Compass, for sources of topographical maps.

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* See Bibliography at end of section.

2. Relate a map of Washington to the location of the same area on a globe of the earth so that the students can see the representation which a map gives of a portion of the earth's surface.

3. Individually, or in small groups, ask the students to examine a topographical map to see what kinds of information are given on the map. List the responses given by the students and then group the findings according to the five categories of what a map tells you as found in pages 11-39, Be Expert with Map and Compass. The five categories are description, details, directions, distances, and designations.

4. Give the students a map with which they are unfamiliar and ask them to find: a) the name of the map area, b) the longitude and latitude of the map area frames, and c) the date of the map edition.

5. Ask the students to study the more important map symbols given on page 13, Field Study Manual for Outdoor Learning and pages 16-21 of Be Expert with Map and Compass. Provide some drill to develop recall of the symbol's meaning by using flash cards made for the purpose. Having the students make the flash cards would help them in their recall of the meaning of the symbols. Pictures of actual landmarks such as highways, streams, marshes, coniferous trees, etc. may be used to give practice by asking the students to draw the appropriate symbols.

6. Help the students get a better concept of contour lines by having each bring a large rock to school and do the activity shown on page 22, Be Expert with Map and Compass. It is the drawing of contour lines on a rock so as to get a better perspective of contour line on a map.

7. Students can play a game of drawing a map with symbols from the verbal descriptions the teacher gives of the landmarks in an imaginary territory. For more explanation and sample description of imaginary territory features, see page 24 of Be Expert with Map and Compass.

8. Test the students recall of the meaning of map symbols by administering the map quiz on page 23 of Be Expert with Map and Compass. A thermofax ditto master can be made of the map symbol quiz. An alternative quiz on map symbols could be made by making a ditto master from the legend on page 13 of Field Study Manual for Outdoor Learning.

9. Provide students with a map that is unfamiliar to them and ask that they indicate the eight compass points, N, NE, E, SE, S, SW, W, and NW. Then

have the students see how quickly they can locate on the map landmarks which the teacher identifies by a symbol name and a location which is N, or SW, or NE, etc., of a certain point on the map.

10. Have students make a simple paper-circle protractor and label it appropriately with eight points of the compass and the corresponding degree numbers: N -) and 360, NE - 45, E - 90, SE - 135, etc. Folding the paper circle into eights will give the needed point locations.

11. Using the scale for distance on a map, have the students make a scale ruler and then use the ruler to find distance between various points on the map. This could then be extended to determining the distance and direction, using scale ruler and protractor, from one point to another.

12. Using a ruler and a protractor, student can find the names of landmarks designated on a map by degrees, or compass points, and distances from some other landmark or point. A variation is to find and describe, from the symbol meanings, unmarked locations using given directions and distance. See pages 38-39 of Be Expert with Map and Compass.

13. Students can decide on an imaginary walk or drive by examining a map of some area or region. The walk or drive is first described by names of landmarks or by symbol meanings and then by distances and directions from the starting point, out and return.

14. With true or map North indicated by a marker on the appropriate spot of the classroom wall, the students are asked to orient a map to the area it represents. See page 4 of Appendix VI in Outdoor Living for information on finding true or map North from magnetic North.

15. Use a map of the local region or a street map to have the student orient the map to the actual area with the aid of obvious landmarks such as streets, stream, roads, hills, building, etc. Then ask the students to locate a particular landmark by sighting over a directional line on the map running from their location toward the particular landmark.

SPECIFIC UNDERSTANDING

Knowing distances, which is essential to simple navigation, can be accomplished by determining and using the length of one's step.

BACKGROUND INFORMATION

The length of one's pace can be determined by laying out a step course 100 or 200

feet long, walking up the course and back, and then dividing the number of steps into double the length of the course, 200 or 400 feet, or as the case may be. In Roman times, a pace was a double-step but now a pace is generally considered to be one step. Our 5,280 foot mile is based on the fact that one thousand double steps or the average Roman soldier, times the length of the foot of that same soldier, was 5,280 feet.

ACTIVITIES

1. Have students set up a step course and use it to determine the length of each individual's step. See pages 42-43 of Be Expert with Map and Compass and pages 7-8 of Field Study Manual for Outdoor Learning for details, formulas and variations.

2. For greater accuracy in determining distances, have the students tie their ankles with a twine so that their step is held to a constant length.

3. A "treasure hunt" could be a game for the students in which they are to find some small prize hidden at a certain distance along a straight-line direction.

4. Give the students practice in following a route and locating on the map landmarks found along the way. Lay out a simple course and mark certain landmarks in an inconspicuous way with a pointer to give direction for travel. For the route, make a map which will give distances and direction for reaching each subsequent landmark to be found, and describe. The students will use copies of the map to step the distances in the directions indicated and find each marker and describe the landmark indicated.

SPECIFIC UNDERSTANDING

By properly using a compass and accurately pacing distances, one can navigate in unfamiliar surroundings.

ACTIVITIES

1. After having the students examine a compass rose, ask them to label the 16 points of the compass rose on an outline of the rose. See pages 53-54 of Be Expert with Map and Compass for information on the compass rose and an unlabeled figure of the 16 points of the rose which can be copied for student use.

2. Play a simple game of having the students face in the direction of various points of the compass as the teacher calls out the directions. See pages 54-55 of Be Expert with Map and Compass.

3. Allow each student to examine the three parts of a Silva compass as the teacher explains the function of each part. See pages 58-59 of Be Expert with Map and Compass and pages 8-9 of Field Study Manual for Outdoor Learning for descriptions and functions of the parts of a Silva compass.

4 Suspend a bar magnet from the ceiling by a strong thread and allow the magnet to align with the magnetic lines of the earth. Then have the students compare the alignment with the direction pointed by their compass needle. Caution: Do not allow the magnet to influence the compass needle by bringing the compass too close to the magnet when the bearings for magnetic North are taken.

5. Using a Silva compass, have each student point out the direction of the four cardinal and four intercardinal points of the compass and give the corresponding degree reading for each of the points.

6. Using a Silva compass, have each student find the bearing of various landmarks around the school area. Then, ask each student to find the degree bearing of a nearby landmark and use the compass to follow as he walks to the landmark and returns to the original spot by following the 180 degree opposite of the first bearing. See pages 61-63 of Be Expert with Map and Compass, pages 9-10 of Field Study Manual for Outdoor Learning, and page 7 of Appendix VI of Outdoor Living for information and diagrams on using the Silva compass.

7. In a wooded or grassy area near the school, have each student use a Silva compass in a Three-Legged Compass Walk or in Boxing the Compass to return to a starting point. See pages 64-66 of Be Expert with Map and Compass for a description of a Three-Legged Compass Walk. The following description can be used by Boxing the Compass.

> "Boxing or Squaring Your Compass"--Find a relatively level spot with a little or no underbrush so that the students, working individually, can move with ease. Give the following instructions:
>
> Hold the compass with both hands at waist height. Align the compass needle, dial housing and direction of travel arrow with magnetic north. Turn your body to face North. Pick out any prominent object directly North as indicated by your compass. Walk 50 paces North (or any other appropriate measure), keeping your eyes on the sighted object. Stop.

Turn the direction of travel arrow indicator until the arrow is lined with 90 degrees on the dial housing. Site any new object to which the direction of travel arrow points and, keeping your eyes on the sighted object, walk 50 paces in its direction. Your compass needle will remain oriented with North as you travel in this easterly direction. Stop.

Turn the direction of travel arrow indicator until the arrow is lined with 180 degrees. Site any new object to which the direction of travel arrow points and walk 50 paces in its direction. As above, your compass needle should remain oriented with North. Stop.

Repeat the activity with the direction arrow pointing to 270 degrees and you should return to your exact starting point.

8. Assign students some of the methods of locating North without a compass and then have them compare their findings to bearings for true or map North and for magnetic North.

   a. On thickly wooded slopes moss tends to grow on the north and northeast sides.
   b. The leaves of the prickly lettuce grow horizontally from the stem in a north-south direction.
   c. Sometimes significant points in the region about you can also be located on your map and then the map can be oriented accordingly.
   d. The rising and setting sun can help you locate a northerly direction.
   e. If you guess when noon occurs and face the sun, you are facing in a southerly direction.
   f. If you know the exact time for solar noon, the shadow of an object at that exact time points in a north-south direction.
   g. If you know the exact time for sunrise and sunset, you can find a point midway between these which will give you solar noon and proceed as in f).
   h. Using a vertically mounted stick, mark the lengths of its shadow on paper or on the ground at five-minute intervals or less around noon. The shortest shadow is the north-south line.
   i. A watch set on Standard Time can be used as an emergency compass. (How to Use a Watch for a Compass: Turn the watch until the hour hand points to the sun. The line halfway between the hour hand and 12:00 is south.)

j. Locate the North Star. Draw an imaginary line between the "pointer" stars at the end of the bowl of the Big Dipper. Extend this line five times its original length and you should arrive at a second magniture star which is approximately true north.

k. Observe, over the course of the evening, the apparent movement of the stars. They seem to move in a westerly direction.

l. Note the time of moon rise and moon set; find the time halfway between, face the moon at that hour, and you will be facing in a southerly direction.

9. In a wooded area, lay out a course for a Miniature Compass Walk in which the students use given compass bearings and distances to follow with the aid of a Silva compass. See pages 67-68 of Be Expert with Map and Compass for details of the walk.

10. Have a compass competition in which the students must use accurate compass bearings and pacing in using particular directions to return to an exact starting point. See pages 69-72 of Be Expert with Map and Compass for the details of setting up the competition markers and the compass bearings and distances for ten different starting points.

11. Orient a map of the local area to map or true North by using a Silva compass. Be sure that the students adjust for the 22 degrees of declination here in Western Washington. See pages 88-93 of Be Expert with Map and Compass and page 7 of Appendix VI in Outdoor Living for information on compass declination and adjustments.

12. Orient a map of the Whidbey Island region to the Camp Casey site by using a Silva compass. After the students have oriented the map, have them locate and identify certain prominent landmarks by sighting over the directions plotted on the map.

13. At Camp Casey, have individuals or small groups of students search for a particular spot to find a natural shelter which would serve to lessen the danger of hypothermia. After finding a shelter, the student(s) are to take compass bearings and determine distances on their return to the starting point. These bearings and distances will then be the directions for other students to use in finding the shelter.

14. Have the students take field notes as they move around the Camp Casey site. From these notes, ask the students to draw a map of the area of their travels. The directions and forms of record sheets for mapping can be found on pages 10-15 of Field Study Manual for Outdoor Learning.

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2 Climbers Found Safe On Mt. Hood

GOVERNMENT CAMP, Ore. — (AP) — Two mountain survival experts yesterday were found safe after outlasting five nights of ferocious storms high on Oregon's Mt. Hood.

When spotted, they were only about one-half mile from Timberline Lodge, from where they started last Sunday to climb the 11,245-foot mountain. And they were making their way back under their own power.

They had spent four nights in a hole they dug in the snow at the 10,000-foot level, and a fifth night in another hole burrowed at about the 6,500-foot level.

After nearly two hours of treatment and slow thawing out, they were sent to a hospital in Portland, where doctors said they were in relatively good condition and will not lose any fingers or toes.

One of the men is Dr. Latham Flanagan, a 34-year-old physician and surgeon from Eugene who is considered an authority on hypothermia, or low body temperature.

His companion was Dale Moon, a 32-year-old survival specialist with a park and recreation district near Eugene.

They were so chipper when they arrived at the Portland hospital that they smiled through cracked lips and held a brief news conference before being wheeled off for examination.

"You shiver a lot," one cracked when asked how they kept warm.

Moon added:

"You don't give up or we'd have been dead two or three days ago."

Men directing the search said it was knowledge of survival techniques that pulled them through. Dr. Flanagan added that they had the right kind of equipment.

Flanagan and Moon started from Timberline, a lodge and skiing resort on the south face of the cone-shaped peak, at 3 a.m. last Sunday. The weather was good, but a storm struck about the time they reached the summit at 1 p.m.

It took them until 5 p.m. to get back down to the peak's broken crater area. That's where they dug in at the 10,000-foot level.

Flanagan said the ensuing storm was whipped by winds they estimated at 70 knots, more than 80 miles an hour, and temperatures dropped below zero. The temperature in their snow cave stayed in the mid-20s.

While they huddled in one sleeping bag beneath the snow for four nights — Flanagan timed it at exactly 87 hours — the vicious storms twice turned back searchers.

Idaho Hunter Survives 53-day Ordeal in Wilds

AP, UPI

SUN VALLEY, Idaho — A bearded hunter staggered out of the snow-covered mountains of Central Idaho yesterday, winning a 53-day fight for survival.

His partner later was found dead in the wilderness where the two became stranded by heavy snow on a deer hunting trip on Nov. 28.

Officials had given up the pair for lost more than three weeks ago.

Robert Bailey, 28, stumbled into the Devil's Bedstead Guest Ranch on Big Lost River, about 15 miles northeast of here, shortly after noon.

"It's good to be alive — there were times when I didn't think I'd make it," Bailey said from his hospital bed at Sun Valley. "I never was much of a church-going man, but I know now there is a God. God took real good care of me."

Bailey said his journey began some 28 days ago after he gave up hope that rescue parties would find his stranded truck.

"I've always been told that when you get lost, stay put. We did that, but after a while we decided that we'd stayed put long enough and I tried to walk out of there."

He had fought his way for more than a week through deep snow and across rugged mountain ranges.

"Bailey was in extremely good condition for what he had been through," said Danny Danielson, a helicopter pilot who picked up the survivor and flew him to Sun Valley.

"Bailey told me he'd been walking out — about 30 miles I guess it was — for 10 or 12 or 13 days, he couldn't remember just how long," Danielson said, adding:

"He said he found cabins along the way where he stayed. Some had food. And when he didn't have shelter, he burrowed into the snow and covered himself up with it to stay warm."

Found dead in an area known as Copper Basin, about 30 miles east of Devil's Bedstead, was Joe Conquest, 34, of Jerome, Idaho.

"He was in the car," said Danielson. "It was right off the side of the road . . . only the roof was showing above the snow."

Temperatures in the area reached 40 degrees below zero during the pair's ordeal. Snow was 10 feet deep.

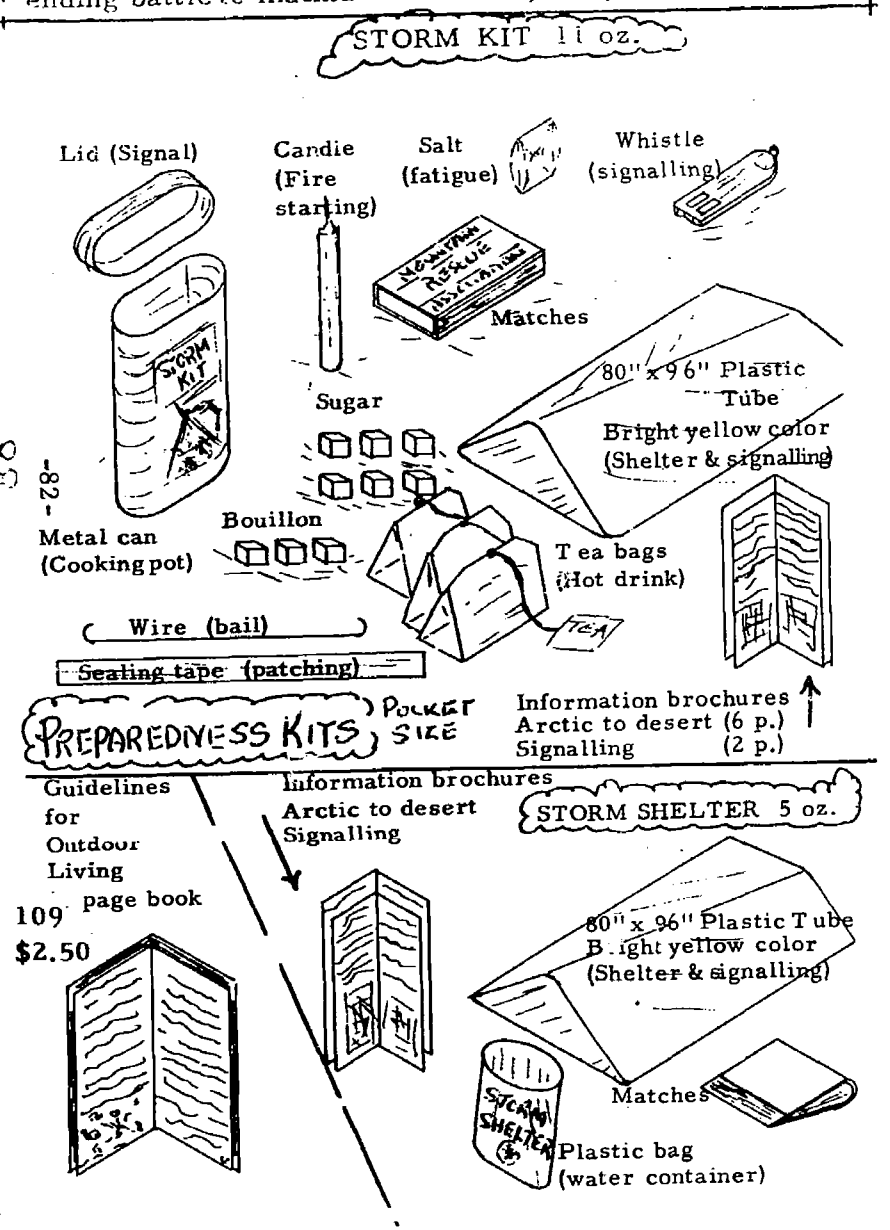
Bailey, of Wendell, Idaho, and Conquest left on their hunting trip with only a two-day supply of food, relatives said.

Bailey said he kept a day by day diary of his experiences in the wilderness and hopes to put the information into an article that will pay for his hospital bills and rescue operations.

"I haven't had one bit of survival training. The first night out I didn't think I'd make it. I'd only traveled three or four miles during the day. I knew if I stopped, I would freeze.

"I had heard that if you crawled under the snow you could keep warm. I dug down and stayed in the hole throughout the night. I was cold when I got up in the morning, but I didn't freeze."

volunteer effort is dedicated to saving lives through ue and safety education. But year after year our statistics show that we were often too late to save a life because the victim could not help himself in the never-ending battle to maintain necessary body heat minimums.



MOUNTAIN RESCUE COUNCIL, TACOMA UNIT
P.O. Box 696, Tacoma, Washington, 98401
- Member of MOUNTAIN RESCUE ASSOCIATION -

The unpaid volunteer men of Mountain Rescue, when they are not in the field helping a fellow human who had misfortune, assemble a small, lightweight all-purpose kit for short term survival situations. This kit is designed to aid a person in distress by helping to keep the inner and outer body warm, dry, and alive through providing the immediate necessary WARMTH - SHELTER - ENERGY - and INFORMATION.

SIMPLE BASIC PREPAREDNESS KITS

STORM KIT	- 11 oz.	$2.00	Mailed
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BASIC INFORMATION BOOKS and BROCHURES

GUIDELINES for OUTDOOR LIVING (Teachers, leaders)	109 Pages	$2.50	Mailed
MOUNTAINEERING MEDICINE (All outdoorsmen)	35p.	$1.00	postage prepaid
CARELESS EV Cartoons		$1.00	

Ten 8½x11 cartoons and 1 plastic frame

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KNOWLEDGE could have made many an outdoorsman's miserable journey a PLEASANT one, and could have given many an outdoorsman a SECOND CHANCE at Life.

All profits from kits and publications are used to promote our dedicated purposes:
"Saving lives through Rescue and Safety Education."

FOUR LINES OF DEFENSE AGAINST HYPOTHERMIA

From the motion picture
...BY NATURE'S RULES

SAFECO INSURANCE

MOUNTAIN RESCUE

COLD KILLS IN TWO DISTINCT STEPS

STEP ONE: EXPOSURE AND EXHAUSTION

The moment your body begins to *lose heat* faster than it produces it, you are under-going exposure Two things happen:

1. You voluntarily *exercise to stay warm.*
2. Your body makes involuntary adjustments to preserve *normal temperature in the vital organs.*

Either response drains your energy reserves. The only way to stop the drain is to reduce the degree of exposure.

- **THE TIME TO PREVENT HYPOTHERMIA IS DURING THE PERIOD OF EXPOSURE AND GRADUAL EXHAUSTION.**

STEP TWO: HYPOTHERMIA

If exposure continues until your energy reserves are exhausted.

1. Cold reaches the brain depriving you of judgement and reasoning power. *You will not realize this is happening.*
2. You will lose control of your hands

This is hypothermia Your internal temperature is sliding downward Without treatment, this slide leads to stupor, collapse, and death.

YOUR FIRST LINE OF DEFENSE: AVOID EXPOSURE

1. STAY DRY When clothes get wet, they lose about 90% of their insulating value. Wool loses less; cotton, down, and synthetics lose more.
2. BEWARE THE WIND A slight breeze carries heat away from bare skin much faster than still air. Wind drives cold air under and through clothing. *Wind refrigerates wet clothes* by evaporating moisture from the surface. WIND MULTIPLIES THE PROBLEMS OF STAYING DRY.
3. UNDERSTAND COLD. Most hypothermia cases develop in air temperatures between 30 and 50 degrees. Most outdoorsmen simply can't believe such temperatures can be dangerous. They fatally underestimate the danger of being wet at such temperatures.
   - 50 degree *water* is unbearably cold. The cold that kills is *cold water* running down neck and legs. *cold water* held against the body by sopping clothes, *cold water* flushing body heat from the surface of the clothes.

- DON'T ASK, "HOW COLD IS THE AIR?" ASK INSTEAD, "HOW COLD IS THE WATER AGAINST MY BODY?"

4. USE YOUR CLOTHES. Put on raingear *before* you get wet. Put on wool clothes *before* you start shivering.

YOUR SECOND LINE OF DEFENSE: TERMINATE EXPOSURE

If you cannot stay dry and warm under existing weather conditions, using the clothes you have with you, *terminate exposure.*

1. BE BRAVE ENOUGH TO GIVE UP REACHING THE PEAK OR GETTING THE FISH OR WHATEVER YOU HAD IN MIND.
2. Get out of the *wind and rain.* Build a fire Concentrate on making your camp or bivouac as secure and comfortable as possible

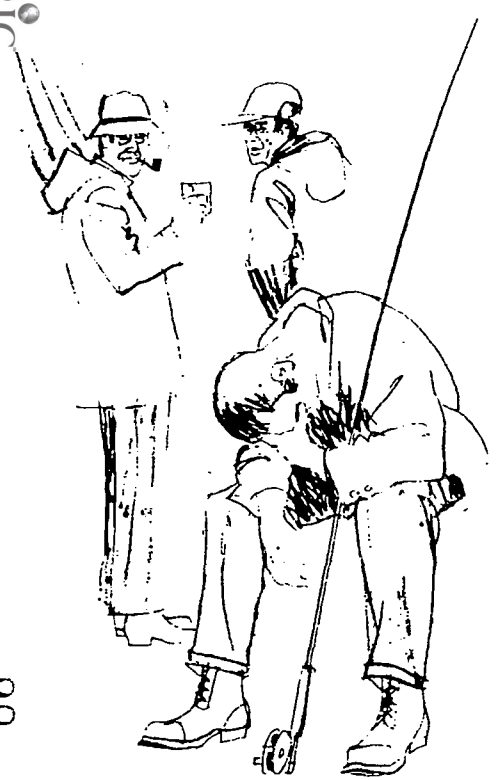
NEVER IGNORE SHIVERING

Persistent or violent shivering is clear warning that you are on the verge of hypothermia. MAKE CAMP.

FORESTALL EXHAUSTION

Make camp while you still have a reserve of energy Allow for the fact that exposure greatly reduces your normal endurance.

You may think you are doing fine when the fact that you are exercising is the only thing preventing your going into hypothermia. If exhaustion forces you to stop, however briefly.



THINK HYPOTHERMIA

If you are outdoors for recreation, you presumably do not intend to jeopardize your life.

Hypothermia may be a new word to you, but it's the *only* word that describes the rapid, progressive mental and physical collapse accompanying the chilling of the inner core of the human body.

Hypothermia is caused by exposure to cold, aggravated by wet, wind, and exhaustion. It is the #1 killer of outdoor recreationists.

- **TAKE HEED OF "HYPOTHERMIA WEATHER."**
- **WATCH CAREFULLY FOR WARNING SYMPTOMS.**
- **CHOOSE EQUIPMENT WITH HYPOTHERMIA IN MIND.**
- ***THINK HYPOTHERMIA.***

NOTES ON EQUIPMENT

Choose rainclothes that are proof against *wind-driven* rain and cover head, neck, body, and legs. Polyurethane coated nylon is best. The coatings won't last forever. Inspect carefully and test under a cold shower before you leave home. Ponchos are poor protection in wind.

Take woolen clothing for hypothermia weather: 2-piece woolen underwear...or...long wool pants and sweater or shirt. Include a knit cap that can protect neck and chin. Cotton underwear is worse than useless when wet.

A stormproof tent gives best shelter. Take plastic sheeting and nylon twine for rigging additional foul-weather shelter.

Carry trail food...nuts, jerky, and candy...and keep nibbling during hypothermia weather.

Take a gas stove or a plumber's candle, flammable paste, or other reliable firestarter.

- **DON'T WAIT FOR AN EMERGENCY. *USE* THESE ITEMS TO AVOID OR MINIMIZE EXPOSURE.**

FILM

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1. Your rate of body heat production instantly drops by 50% or more.
2. Violent, incapacitating shivering may begin immediately.
3. You may slip into hypothermia in a matter of minutes.

APPOINT A FOUL-WEATHER LEADER

Make the best-protected member of your party responsible for calling a halt before the least-protected member becomes exhausted or goes into violent shivering.

YOUR THIRD LINE OF DEFENSE: DETECT HYPOTHERMIA

If your party is exposed to wind, cold, and wet, THINK HYPOTHERMIA. Watch yourself and others for symptoms.

1. Uncontrollable fits of shivering.
2. Vague, slow, slurred speech.
3. Memory lapses. Incoherence.
4. Immobile, fumbling hands.
5. Frequent stumbling. Lurching gait.
6. Drowsiness (to sleep is to die.)
7. Apparent exhaustion. Inability to get up after a rest.

YOUR FOURTH AND LAST LINE OF DEFENSE: TREATMENT

The victim may deny he's in trouble. Believe the symptoms, not the patient. Even mild symptoms demand immediate, drastic treatment.

1. Get the victim out of the wind and rain.
2. Strip off *all* wet clothes.
3. If the patient is only mildly impaired:
   a. Give him warm drinks.
   b. Get him into dry clothes and a warm sleeping bag. Well-wrapped, warm (not hot) rocks or canteens will hasten recovery.
4. If the patient is semi-conscious or worse:
   a. Try to keep him awake. Give warm drinks
   b. Leave him stripped. Put him *in* a sleeping *bag* with another person (also stripped). If you have a double bag, put the victim between *two* warmth donors. *Skin to skin contact* is the most effective treatment
5. Build a fire to warm the camp

"WINDCHILL"

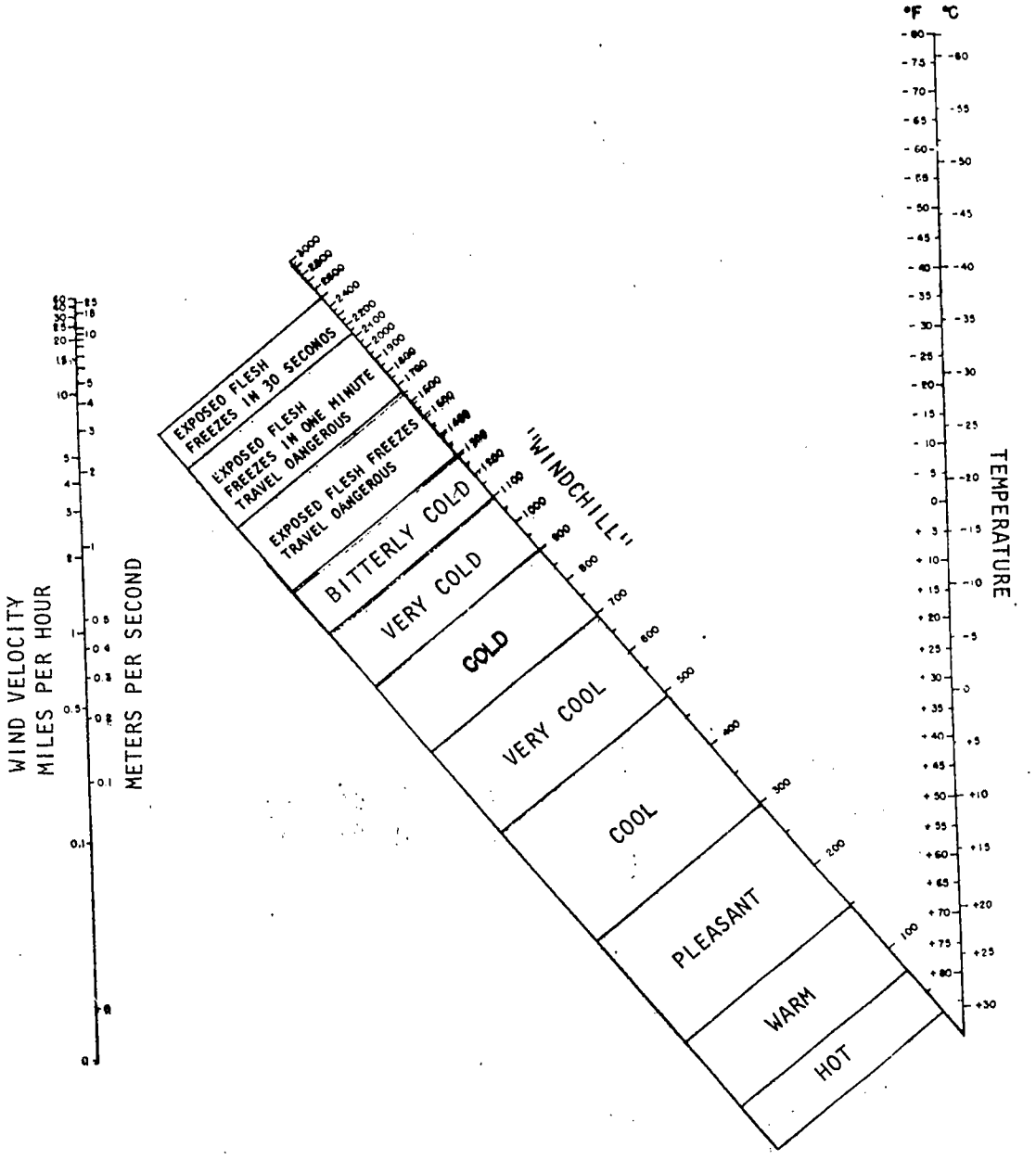


Figure 3. LINE CHART SHOWING WINDCHILL and state of comfort under varying conditions of temperature and wind velocity. (From Consolazio et al.: METABOLIC METHODS, St. Louis, 1951, The C. V. Mosby Company.)

WIND - CHILL CHART *

Estimated Wind Speed MPH	ACTUAL THERMOMETER READING °F.										
	50	40	30	20	10	0	-10	-20	-30	-40	-50
	EQUIVALENT TEMPERATURE °F.										
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57
10	40	28	16	4	-9	-21	-33	-46	-58	-70	-83
15	36	22	9	-5	-18	-36	-45	-58	-72	-85	-99
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125
35	27	11	-4	-20	-35	-49	-67	-83	-98	-113	-129
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132

Wind speeds greater than 40MPH have little additional effect

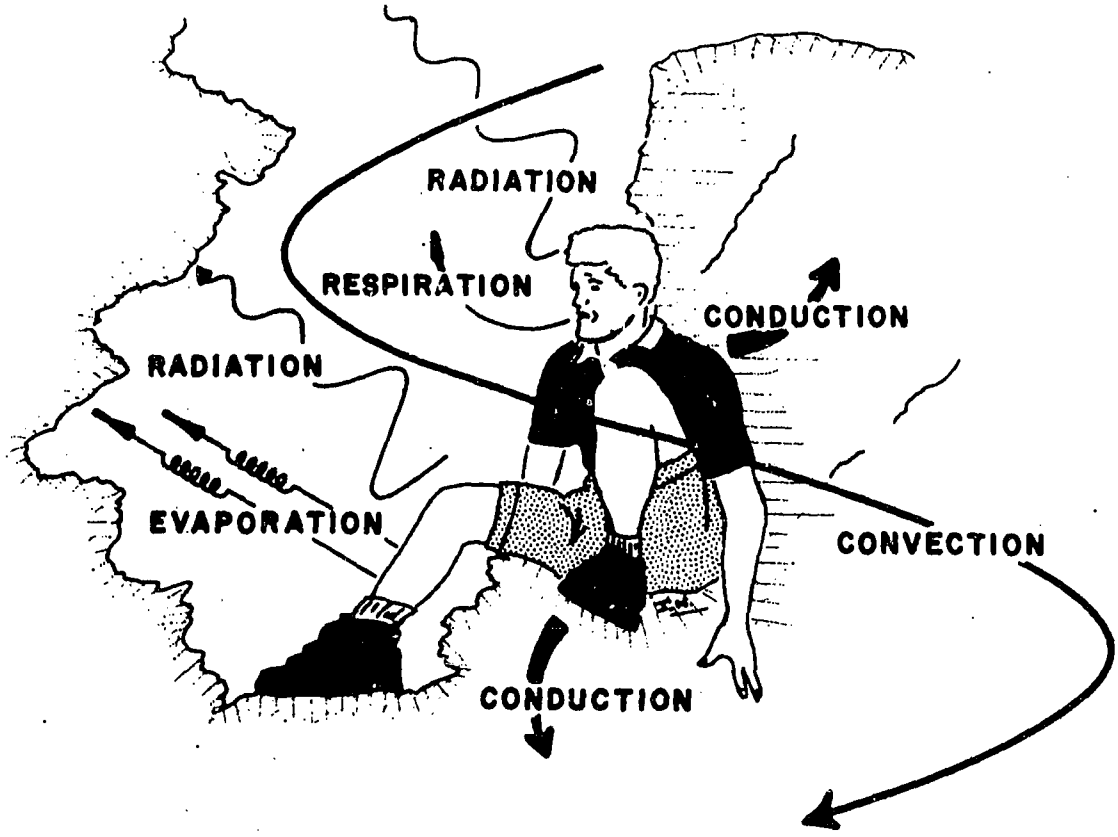
LITTLE DANGER FOR PROPERLY CLOTHED PERSON

INCREASING DANGER

GREAT DANGER

DANGER FROM FREEZING OF EXPOSED FLESH

*Fear, Eugene H., Outdoor Living



MECHANISMS OF HEAT LOSS FROM THE BODY. The illustration assumes that a wet, poorly-dressed climber has taken shelter in a crevasse or among cold, wet rocks. (Based upon a schematic drawing in "Death from Cold" by Marlin B. Kreider, APPALACHIA, June 1960.)

SECTION V

SALTWATER ECOLOGY

The study of the tidal zone is divided into non-living and living elements. Both areas of study affect man and man in turn affects the elements of nature.

ACTIVITIES RELATED TO NON-LIVING ELEMENTS OF BEACH

The activities are divided into four general areas: atmospheric, mineral, physical. observational.

UNDERSTANDING

Atmospheric conditions affect the appearance of the beach and surrounding area. Atmospheric conditions are directly related to the action of the water cycle.

ACTIVITIES:

1. Observe and record general weather conditions. Direct questions which will relate atmospheric conditions to its effect on the beach and water. Plot off an area to use.
   a. Does the plot get more or less sun than surrounding plots?
   b. Does the plot get more or less rain than surrounding plots?

   Materials

   Thermometer, chart, pencils

Weather Record

Date and Time	General Weather Conditions	Temperature	Condition of Soil Surface

2. Water in air--to gather evidence that there is moisture in the air, relating this to part of the water cycle.

   Materials: (teams of two)

   Small vials with screw caps
   Pitcher of ice water
   Plastic bags

   Fill a pitcher with melted ice water. Pour each student's vial half-full with ice water. Do not mention what to observe, or that you are using ice water. Permit students to manipulate vials as they wish, then discuss with them where the water

that has accumulated on the outside of the vials came from. If some suggest that it came from the water inside the vial, ask how they might test this! (By capping vials immediately after filling.)

3. Take ground temperature, water surface temperature, and air temperature. Record on a chart and discuss effects of temperature differences on evaporation.

4. List effects of the wind on the beach and surrounding area. Look especially for trees, banks, plants, and the wind's effect.

5. Look for and discuss water's effect on the beach and surrounding area. Rocks should have evidences of water's effect.

6. Place a stake by the water's edge before the lowest tide has been reached. Place a second stake at the water's edge later. The time interval should have been decided ahead of time (10 minutes, 15 minutes, 1/2 hour, etc.). Measure the distance between the stakes and record the information. Remove the first stake and repeat the process. Continue this until the water level is above the mud flat.

Time		Distance	Tide Coming
From	To	Between Stakes	In or Going Out
9:00	9:15	3 meters	Out
9:15	9:30	1 meter	Changed from Out to In
9:30	9:45	3 meters	In

BACKGROUND

The tides of Puget Sound are complex. Roughly, the tide moves in from the ocean by the Juan de Fuca Strait and proceeds into the bays and coves to the south. However, certain waters such as the waters on the east side of Whidbey Island are contained in basins with narrow inlets. In these basins the tides produce powerful currents like those at Deception Pass.

UNDERSTANDING

Great mineral deposits are present in sea water. The most prevalent mineral is salt. Minerals come from fresh water sources as they wash the minerals from rocks and eventually flow into the sea.

ACTIVITIES:

1. On an incline dig holes in a line beginning on the upper beach area and proceeding toward the water. Look for water level. Discuss water table and saturation.

2. Have groups collect non-living things they find in a certain area. Limit the items as in a scavenger hunt for natural items. Let them bring in all un-natural items that they find. Separate the litter as to burnable and non-burnable. Which is the largest pile? Why does (or doesn't) littering occur in this area? Could you devise a plan for preventing or reducing litter in the area?

3. Look for and discuss ways in which non-living elements provide homes for animals and plants.

4. Determine mineral wealth in soil of the beach area. Have students dampen a portion of soil samples from various areas. With red litnus paper, test acidity-alkalinity of each sample. With blue litmus, also test each of the same sample portions. Label each soil sample with the results. Set samplings aside. Note the origin of each sample. What plant life is growing in each sample source? Take a few leaf and stem samples from the regions the soil samples came from. Crush and moisten each plant sample. Test each with red and blue litmus paper. Are the results what you expected?

5. Determine the relationship of beach area to size of rocks found. Collect rocks from several areas of the beach. Select rocks that represent a typical size from the area. Line up the rocks in gradation. Where are the larger rocks found? Where are smaller rocks found? Where is fine sand found? Why?

6. Since the sea is a great source of water, discuss the possibility of using salt water for irrigation of crops. How could it be transferred to fields? Would any changes have to be made in the water?

7. Look for sources of fresh water which might empty into the sea. Streams may be in the area. How is the mineral content of the sea affected by the source of the water? Use a map of the surrounding area to point out large sources of fresh water.

8. Now look up the slope of the beach from the water line to the high tide mark. Would you describe the area as a steep or gentle slope? _____

_____

What kinds of things would cause a beach area to have a more gentle slope?

_____

_____

How would you describe the composition of the beach?

sandy	muddy	mud mixed with other material
rocky	mixed sand and rock	

Any area exposed to air by the daily tides may be divided into sections or zones as follows:

upper beach	never under water, wet only by spray, sometimes called splash zone
middle beach	uncovered by daily tides for several hours
lower beach	uncovered fully only during lowest tides

Run a line from the water's edge to the top of the intertidal zone. (Use stakes and string.) Study your beach area and see if you can find the different zones described above (sometimes they are not very clear because of other factors). Mark with stakes along your line. Pace off or measure each zone in feet.

1. _____

2. _____

3. _____

Draw and label zones on your map. Sketch in any large rocks or tide pools found in the path of your line.

9. Now use your equipment to collect the following information:

	zone 1	zone 2	zone 3
air temperature	_____	_____	_____
ground temperature	_____	_____	_____
pH	_____	_____	_____
ground composition	_____	_____	_____

time of day _____ season of year _____

air temp. over water _____ atmospheric condition _____

water temp. _____ wind action _____

pH of water _____ wave action _____

O_2 content of water _____

Why is it important to know season and time of day? _____

_____

Are there any differences of temperatures at ground level in zones?

_____ pH? _____ If so, what things may cause these differences? _____

_____

Why do we need to take <u>both</u> air and ground temperatures? _____

_____

Can you think of a non-living factor that is very important in any marine environment and one that has not been measured? _____

_____

_____

UNDERSTANDING:

The salinity of Sound water varies depending on fresh water run-off into the Sound and the exchange of water with the outer Sound by tides.

MATERIALS REQUIRED:

6 - 12 baby food jars (small, clean)
Masking tape (or labels)

ACTIVITIES:

Take water samples by carefully lowering the jar two inches beneath the water's surface. Dry the jar and label it as to time and tide condition using a piece of masking tape or label. Choose a series of sampling times which encompasses a full tide cycle so that salinity can be compared to tide conditions. Carefully pour the water through filter paper to remove the suspended materials.

The water can be evaporated in a dish or carefully boiled away. The sample is boiled. The heat must be watched before the water all boils away or the salt crystals will spatter out of the container. If a scale is available, weigh the dish with and without the salt which is left from a complete bottle of sample water. The difference between the two weights is the weight of the salt. See if there is any difference in salt weight at high or low tide.

UNDERSTANDING:

Non-living elements of the beach have properties and conditions which are laws in physics. Some of these factors can be demonstrated in the following activities.

ACTIVITIES:

1. Feel and discuss the texture of several non-organic elements. Are some smooth? Are some rough? Why? Make comparisons and contrasts on texture, color, and any attributes the children notice.
2. Show water as a conductor of heat. Small portions of water can be warmed by an easy source (the sun, hands, etc.).
3. Oil and water do not mix. Take a small amount of water in a container that is flat and has a sizable surface area. Put a drop of oil on the surface. Discuss the relationship of this and the environmental problems. Should oil exploration be allowed in the Puget Sound area? Why, or why not?
   Materials: Shallow pan, oil

4. Have students state their ideas of how water moves and how water carries other materials. Have them formulate questions about those ideas of which they are not sure. By reading, try to find information related to these ideas and then try making guesses about what they will find when they examine the streams running onto the beach.

5. Look carefully at the bottom of a small stream. Notice what materials are moving along the bottom and how they move. Place a shovel full of material in the stream and collect a sample of water from the surface farther downstream. Let the sample sit until the particles settle out and then see what kind of particles are carried. Notice where the material shoveled into the creek is finally deposited.

6. Measure the speed of the water in various places or in various creeks by seeing how long it takes a little piece of wood to float a measured distance. This can be stated in meters per second. Try to find out how the size of material carried by the stream depends upon the speed of the water.

7. Have the students taste the creek water and compare this to the taste of the Sound water. Follow a small stream to its source which can probably be found a short distance above the beach. The students should be able to recognize that these fresh water streams originate from springs in many cases.

8. Notice that very small streams may actually disappear into the sand and gravel. To see that the stream is being carried underground, dig several holes below where the stream disappears. Determine how far beneath the surface the water level is. Measure the depth of the water level in the holes and construct a drawing.

9. Observation and Inventory of Non-Living Factors

Stand at the water's edge and look down the beach to your right and to your left. Is the beach quite straight or are there curves and projections?

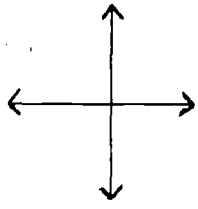
_____

_____

Sketch the curvature of the teach below. Mark your station on the map with an "X" at the water line. Indicate compass directions.

Location _____

Team number _____



How does the curve of the shoreline affect a beach? _____

_____

_____

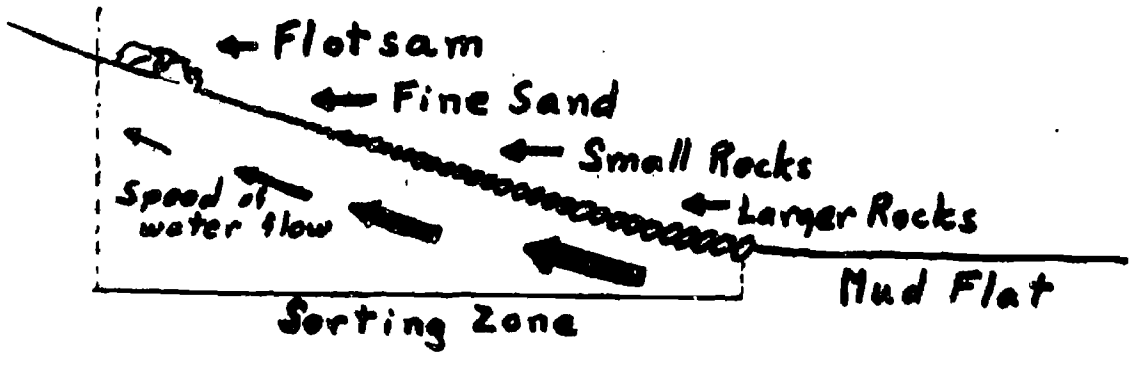
_____

UNDERSTANDING:

Observation of the beach and surrounding area can stimulate thinking. Many attributes can be the results of natural changes and forces.

BACKGROUND:

Wave and tide action tends to sort the sand and rocks by size on various beach levels. Moving water carries material of a size that depends upon the water's speed. The faster the water moves, the larger the size of particles it can carry. The waves, during high tides, cause water to flow up the beach and they slow down as they go higher and higher. Thus the water will drop heavy material low and fine sand high on the beach. Floating material, of course, will be pushed to the highest point by the waves.



ACTIVITIES:

1. Name some natural items you can see from your own place, without moving anything that is:
   a. smaller than a dime
   b. smaller than an apple
   c. larger than a person
2. Sit quietly for a short period of time and listen for sounds. List them orally and put sounds into categories.

   Explain water--slapping against the beach
   roar of the tide

3. Discuss how water can move material either along the bottom, in suspension, in solution, or by floating. Indicate how water speed relates in carrying ability for materials along the bottom. Demonstrate that water in motion carries sand, but that it settles out of still water. Have the students predict how the materials will be arranged along the beach.

4. Observe the general arrangement of materials along the sorting zone. Sorting occurs between the mud flat and the flotsam. The latter is composed of leaves, seaweed, sticks, bits of bark, and sand fleas. Step off a line from the flotsam to the flat and take surface samples along the line. Include a statement of the samples' distances from the flotsam with each sample.

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Moon and How It Affects Us
Mysteries of the Deep
SNA, Volume 2, Bathyscaphe
SND, Salt Water
What Makes Things Float

Activities Relating to Living Elements of Beach

UNDERSTANDING:

Conservation of living elements of beaches is essential. The following items relating to conservation must be emphasized when at the beach:

1. Take Nothing from the Beach Unless There is a Planned Use for It!
   Planning must be done prior to the trip. If you plan to preserve specimens, make sure you know how it is to be done before you collect. If you plan to keep live specimens, make sure you have proper facilities and knowledge to keep them alive.

   Seashore life is best seen and studied in its natural habitat. So, unless there is a good, valid, planned use and reason for a specimen to be brought back into the classroom, leave it undisturbed in its natural setting so it may be observed and studied by other groups to follow.

2. Replace Turned-Over Rocks!
   This suggestion is made because it is a precaution of great importance which is often not observed. The rocks protect many intertidal animals from shore birds and from fatal drying out by the sun and wind between tides. Many marine plants (algae) grow on top of the rocks, where they can absorb radiation from the sun. If we turn over a rock and do not turn it back the way it was, we expose the creatures sheltering beneath it and at the same time destroy the algae which were growing on top, thereby depriving still other animals of part of their feed supply. For similar reasons, if you dig holes, fill them in again.

3. Help Stamp Out Litter!
   Do your part to keep the beaches pleasant and natural for everyone's enjoyment. Never throw any paper, bottles, cans, or other trash on the beach. Make it a habit to always carry a strong bag or other container for your scrap and trash, and always dispose of the bag in a little can or in your home trash can. With expanding use of plastic containers, beach litter is more of a problem than ever before; plastics don't decompose--they will hang around for years. It isn't hard to imagine beaches buried under a carpet of plastic wrap and bleach bottles in years to come, unless we stop the careless discarding of plastics.

4. Watch Your Step!

One person can do considerable damage to plants and animals by carelessly stepping on them, particularly where they grow thickly on rock beds and in shallow tide pools. Think what a group of twenty people will do to the same area, unless each individual makes a conscious effort to walk carefully and avoid damaging living organisms. Avoid using rocks as stepping stones, particularly small ones, as this does not distribute your weight, but concentrates it; any creatures living under the rocks may thus be crushed.

5. Observe Without Destroying

The best general rule which anyone can set for himself when on the beach is to leave things as they are. If you learn something about marine animals beforehand, you can learn more about them by observing them in their natural habitat than by removing them, and you will do them no harm.

6. Respect the Life Forms You Find!

Handle marine animals carefully if you move them. It is senseless to poke these creatures with a stick, or otherwise thoughtlessly disturb and damage them. Some creatures cannot re-attach themselves once they are pried off and will be pounded about and killed when the returning tide rolls back in. Don't pry anything loose from a rock or shell if it seems firmly attached.

UNDERSTANDING:

The intertidal zone offers an excellent opportunity to see representative animal types in a natural setting.

ACTIVITIES:

Many of the animals in the intertidal zones are small, and they are often disguised by color, form, or pattern so as to blend into their natural settings. These animals will not be seen by merely walking about. Get down and actively search for them in such places as the following:

1. Under Surfaces of Rocks

Turn over large rocks and look carefully for organisms beneath as well as on the upper and under surfaces of the rock itself. Always replace these rocks when you are finished with them.

2. Tide Pools

Examine water basins on the boulders closely for moving organisms, animals in cavities, crevices, etc., and in isolated pools of water on the beach. Look for animals hiding in clam holes, at bases of stones, etc.

3. In Loose Rock and Gravel

Dig carefully and examine for worms, clams, and other animals.

4. In Sandy or Silty Areas

Dig out the extensive burrows of the ghost shrimp and its commensals; look for clams and annelids, etc. Find the openings of burrows and try to dig out the animals that make them. Sift the sand for small or obscure animals.

5. On Boulder Surfaces

Hunt on all sides, especially the shoreward and seaward sides, and around rock bases; look into crevices, under shelves and overhangs--these may be especially rewarding in the lower tidal areas where hydroids, anemones, tunicates, and brightly colored encrustations of sponges may be found seeking protection from drying. Use a pick or other blunt instrument to explore the interior of the mussel beds. Hunt around the holdfasts of any attached plants or animals.

6. Eel Grass Beds

Search around the roots. sift the sand, and explore the blades of eel grass.

7. Logs or Driftwood

Look for encrusting animals and break wood open for boring worms.

8. Decaying Vegetation

Pick over decomposing seaweeds for their populations of scavenging Isopods and Amphipods.

9. Dock Pilings

Examine carefully for sea anemones, sea lemons, barnacles, worms, and other life.

UNDERSTANDING:

The distribution of animals in the intertidal zone is not uniform.

BACKGROUND INFORMATION:

Different species are characteristic of high and low tide level; tide-pool dwellers may not occur on exposed rocky surfaces, and vice versa. Many species are found in rather specific locations: under rocks, in decaying seaweed, on the outermost

exposed rocks, etc. These differences in location are in part the result of the need for protection against waveshock, and desiccation. The impact and scouring action of waves permits only those organisms capable of withstanding these stresses to occur in exposed locations. Others seek more protected places. Furthermore, when the tides recede, animals may be exposed to the air for a considerable time. Organisms living at the high tide level must be capable of withstanding long periods of air, drastic temperature changes, and possible exposure to fresh water. Those living at the low tide level are exposed only briefly, sometimes only once or twice a month when the lowest tides occur. Thus, the "vertical" distribution of animals in the intertidal zone reflects varying abilities of different species to withstand exposure.

Food habits also help to explain the location of animals in the intertidal zone. Plankton feeders subsist on microscopic organisms, collectively termed plankton, which occur abundantly in sea water. Most of these are sessile types--fixed in position as in the case of barnacles, sponges, etc. Predators kill and eat other animals. Herbivores feed on plants. "Grazers," a special group, are exemplified by the majority of snails, these animals feeding by means of a band of horny teeth (radula) which is scraped over surfaces. They feed on seaweeds and on the film of minute organisms on rock surfaces. Scavengers feed on the dead remains of other organisms--plant and animal.

UNDERSTANDING:

Ecology is the study of the interrelationships of organisms to one another and their environment.

BACKGROUND INFORMATION:

Ecology gives one the dynamic aspects of living and yields valuable and interesting information about why and how organisms are found where they are, how they interact with each other, and perhaps most important of all, what could happen if man interferes in his usual haphazard fashion.

There are few better places to observe ecological relationships than on the tidal beach where so many different organisms can be easily observed and observable variables exist, such as salinity, temperature, and substratum.

The marine beach immediately appears different from the fresh water beaches. Obviously this is the result of the interrelationship of the organisms and the environment.

ACTIVITIES:

1. When on the beach, look very closely at the following two environmental conditions. Below these are listed some of the many factors which would affect the organisms living here:

Marine (salt water)	Tidal
Wet	Temperature range great--freezing to 100°
Salty	Exposure to drying
Temperature mediator	Exposure to predators, man, birds
Solvent	Periodic fasting
Buoyant	

Look for special adaptations of the tidal animals themselves for living in this environment.

Crabs (notice that they are out of water)
require structures to keep gills wet while tide is out

Barnacles (notice the excrement around their shells)
excrete at the last few waves to provide maximum water retention

Anemones (compare those out of water with those in water)
retain large quantities of water to withstand drying while the tide is out.

Limpets (notice how tightly the shell fits the substratum)
able to pull the shell tightly against the substratum to prevent drying.

Chitons (notice where they are found)
usually found at bases of rocks to avoid sun--are camouflaged to protect themselves against predators.

Clams (where are they?)
deep in the sand, these animals avoid much of the tidal exposure

Other (look for special adaptations for other tidal animals found in your area)

2. Relationships between Living Organisms

a. Competition

Generally competition is not obvious because if one organism successfully competes for some commodity, it will be the only organism present. There are several kinds of competition, however, which can be seen on the beach.

(1) Competition for Space

Generally marine invertebrates produce astronomically large numbers of progeny. These settle all over the substratum, far more than there is room for. Once a space has been vacated, many of these larvae will try to occupy it competing against each other for room to grow.

Look around the beach and note the substratum.

Is much unoccupied space available? (Try to find a place where man has not interfered.)

little is usually found.

Would you say that where there are organisms, they are crowded?

very crowded

Notice several rocks. Why do you suppose they all have the same species on them?

this species is best adapted to that area and competes most successfully.

(2) Competition for Food

No animals can live without food. When the tide comes in, tidal animals scurry about feeding before the next obligatory fast at low tide.

Look around the beach:

Do you see much available flesh for the meat eaters? (If there was any, chances are that the birds would eat most of it.)

no

How do you suppose the animals here obtain their food?

by breaking open animals found there--barnacles, mussels, etc.

Do you suppose that some organisms can compete for food better than others?

yes

What evidence is there for your previous answer? (Hint: would their numbers be an indication of their competing ability?)

only a few carnivores are found in abundance--crabs, sea gulls, snails, starfish

(3) Competition for Homes

This type of competition is easy to observe in the vary common hermit crabs. Notice that these occupy empty snail shells.

Look around the beach:

Do you find any empty snail shells?

usually not

Can you find any hermit crabs in shells that are too small, indicating a compromise?

many crabs will be found with shells so small that the shell only partially covers the soft abdomen exposing the animal to predation.

b. Food Webs

A very interesting picture can be made if one knows on what various organisms feed. This can be uniformly done by starting with one or more producers (on this beach it would be algae, plankton, or eel grass), writing their names in the center of a paper. Arrows can then be drawn from the producer to organisms that eat it. The arrow can be read as "is eaten by" and the point of the arrow should be towards the consumer. This can be done again and again, one arrow per consumption. Each organism should be written only once; consequently, if an organism eats several things, several arrows can be drawn from these to the one organism. The more organisms and arrows, the better.

Food webs can be very useful to indicate interrelationships. Many "what if's" can be applied to the web and the results readily seen. For example, what would happen if the plankton was destroyed by a change in water temperature, or if starfish were destroyed to protect clams?

UNDERSTANDING:

A tidal zone diagram will help to identify the homes of some marine animals. It will be noticed that some of them live in two or more of the zones. Each of the zones is numbered.

Zone 1, for example, is almost completely dry, receiving only spray from storm waves or very high tides. Only pill bugs and little snails called periwinkles live here. Just below this driest section is the beginning of the belt occupied by barnacles, mussels, and limpets.

Zone 2 is the high tide belt which is usually covered with water twice each day. In addition to barnacles, black turban snails, and other shellfish, this is also the home of the young hermit crabs, shore crabs, and worms.

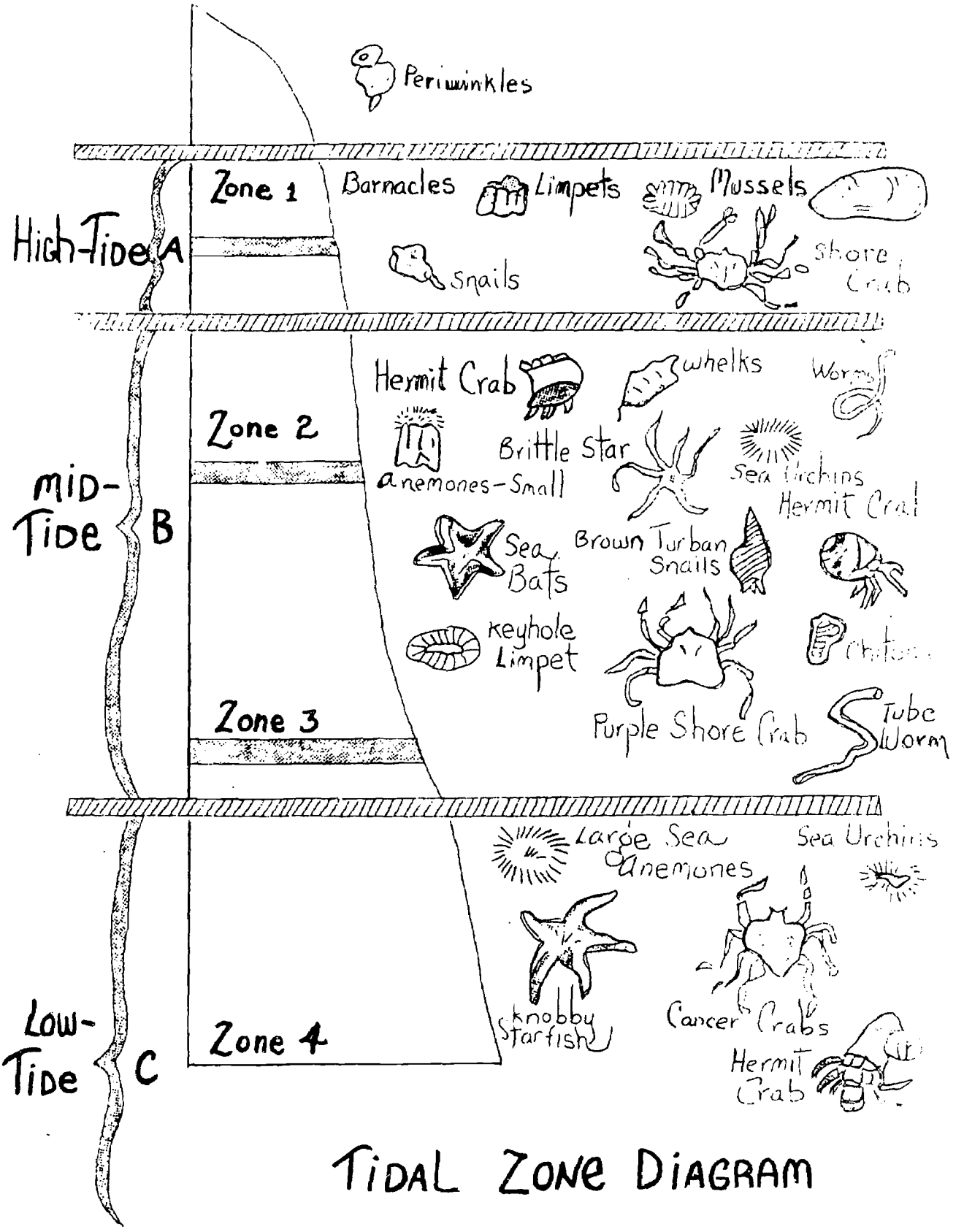
Zone 3 is the mid tide belt which is typically covered twice each day and uncovered twice each day. Although zones 2, 3, and 4 are all part of the area known as intertidal, this zone is the true intertidal zone. Animals found here include small anemones, brittle stars, hermit crabs, sea bats, purple shore crabs, brown turban snails, chiton, and many varieties of tube worms.

Zone 4 is the low tide belt which, except for a few hours each month, is always covered with water. This zone is inhabited by large sea anemones, knobby starfish, cancer crabs, sea hares, sea urchins, adult hermit crabs, and many other species of marine life.

Some Common Marine Animals (this is not intended to be a complete listing)

plankton (microscopic plant and animal life)

sponges	sea urchins	squid
hydra	sea cucumbers	octopus
jelly fish	sand dollars	barnacles
sea anemones	chiton	sand fleas
ribbon worms	oysters	shrimp
sea mouse	mussels	isopods
pile worms	scallops	crabs
clam or sand worms	clams	blennies
tube worms	nudibranch (sea slug)	hermit crabs
starfish	snails	sea pen
brittle star	limpets	



TIDAL ZONE DIAGRAM

ACTIVITIES:

The following activities are suggested for use of the students when observing animal life in the various tidal zones.

1. Inventory of Living Factors in Saltwater Community

   Beginning with zone 1, inventory the animals found in each zone. Include only those organisms within an area of one foot on each side of your string (total area = 2 feet in width across). If you do not know the common name, try to describe the organism briefly or make a sketch.

   Replace any rocks as you found them! If the beach is all sand, you will need to replace sand in any holes dug. Observe carefully!

Zone 1	
Animals	Description

Zone 2	
Animals	Description

Zone 3	
Animals	Description

In which zone did you find mainly animals and plants that cannot survive in water? _____

In which zone did you find the greatest number of different kinds of animals?

_____

Do more animals live on a sandy beach or a rocky beach? _____

_____. Why do you think so? _____

In which zone are the living things in greatest danger of drying out as a result of daily tidal action? _____.

Choose three different animals and examine them carefully for the following characteristics:

Name of organism	Zone found	How is it protected against wave action?	How does it keep from drying out

Give an example of the following from the organisms you observed today:

A producer _____

A consumer _____

A predator _____

A scavenger _____

A grazer _____

A plankton feeder _____

Collect a plankton sample by pouring several containers of water through your net. Place the contents in a plastic bag for later observation at the microscope or microprojector station.

Describe or sketch some of the organisms in the space provided below. Which ones are most numerous?

2. Choose one fairly good-sized rock and inventory completely for both plant and animal life. Be sure to look under any attached seeweeds and in between any mussels or barnacles. When you are ready to turn the rock over, do so as gently as possible and return it to its original position as quickly as possible.

Why? _____

_____

Organisms on top of rock (name or describe):

_____

_____

_____

Organisms on sides of rock (name or describe):

_____

_____

_____

Organisms under rock (name or describe):

_____

_____

_____

When tides change, what problems do plants and animals living on the rock have as compared with organisms that live under the rock?

_____

_____

Do you see any animals that live close together in large numbers? _____

_____

For what kinds of things must these animals compete? _____

_____

Can you think of any special advantages of living together in such close association?

_____

Find some closed barnacles. Can you open them with your fingers? _____ How does the shell protect the barnacle from predators as well as changes due to low tide? _____

_____

What kinds of things might destroy or kill barnacles? _____

_____

Sea Anemones

Where found (habitat) _____

Description (size, color, shape, etc.) _____

_____

Find an open anemone and gently touch the tentacles. How do they feel? _____ What does the animal do when you touch one tentacle? _____

When you touch several? _____

How do you think anemones capture their food? _____

_____

What kinds of things might they feed on? _____

_____

Does a shadow passing over an open anemone cause it to close?

_____

Star Fish

Where found (habitat) _____

Description (size, color, shape, etc.) _____

_____

Gently pry the animal loose, turn it over and look for the mouth opening in the center of the arms. The animal feeds by extending its stomach out through the mouth opening. How do you suppose it opens the clams it feeds on? _____

_____

3. Animal Behavior

You may be asked to choose one or more of these activities either on an individual or group basis.

Shore Crab (handle gently)

Where found (habitat)_____

Description (size, color, shape, etc.) _____

_____

How does it move?_____

Do you think the crab can tell light from dark?_____

What can you do to find out?_____

Results?_____

Can the crab find a wet place if you move it to a dry one? _____

How does the crab eat?_____

Can you tell a female crab from a male?_____

Why is the shore crab a good beach scavenger?_____

_____

Barnacles

Where found (habitat)_____

Description (size, color, shape, etc.)_____

_____

Do they move?_____

Find a tide pool where barnacles are open and observe them feed. Describe. (The feathery structures that move are actually their feet.)_____

Pass your hand or an object a little above an open, feeding group.

What happens?_____

_____

Place the animal in a tide pool or shallow water area and watch it move. Can you describe the movement?_____

Gently turn the animal over on its back in the water and observe for several minutes. Describe what it does._____

_____

Can you find any eyes on the starfish?_____

Is there any evidence at all that these animals can tell light places from dark places?_____

Sea Gulls

What kinds of places in the area are the birds found?_____

_____

Describe the animal (size, shape, color, etc.)_____

_____

Do you see any nests? _____Where do you suppose the birds lay their eggs and raise their young?_____

_____

Is there any evidence that they can communicate with one another?

_____If so, describe._____

Do they stay together in large groups most of the time or not?___

How does a gull feed?_____

Where do gulls feed?_____

Why do you suppose sea gulls are considered to be good beach scavengers?_____

Why are sea gulls protected by law from being harmed or killed?

_____

See if you can find any sea gull feathers to observe. How does the structure of the feather help the bird to fly?_____

_____

MATERIALS NEEDED:

Materials needed for the study of saltwater animals:

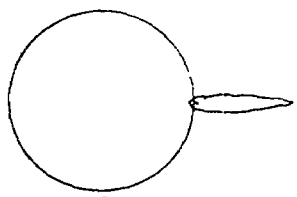
Plankton nets and bottles for plankton samples
Wooden stakes and string to mark off tidal zones
Trays to collect animals that can be observed without a microscope
Microscopes for plankton samples
Glass slides
Eyedroppers
Specimen trays for examining seashore critters
(Note: collect T.V. trays or any tin pans. Spray with white enamel paint. Use these to put creatures in that can be observed without the aid of a microscope.)

Plankton Net Construction:

Materials needed:

Nylon sheer mesh stocking (without holes)
Coathanger
4-6 oz. medicine bottle
Needle and thread

Bend coathanger in a hoop shape approximately 8 inches in diameter. Twist a handle.



Sew the top of the nylon stocking to the hoop; wrap around several times and sew securely.

Cut a hole in the toe of the stocking, tie the bottle securely to the stocking.

How to use a plankton net:

In teams of four, collect plankton samples. Have two students hold the net--one on each side. One student fills a pail with sea water. One student holds the bottle steady while the water is poured slowly through the hoop opening. Pour four to five pails of water through the net. Untie the net. Cap the bottle to take back to the microscopes or micro-projector station.

REFERENCES:

The following films are available from the King County Film Library.

Animal Life at Low Tide

(close-up of low tide inhabitants)

Beach and Sea Animals

(characteristics of invertebrates in and near the beach)

Life Between Tides

(pictures intertidal life)

Life in the Sea

(three general groups: plankton, the bottom-dwellers, and free swimmers)

Life Story of the Oyster

(the place of the mollusk in the marine food cycle)

Life Story of the Sea Star

(characteristics and life cycle of the starfish)

Plankton: Pastures of the Ocean

(production of most of the food on which marine animals exist)

The Pacific Coast Seashore

(plants and animals of the Pacific Coast)

Seashore Life

(ecology in three kinds of seashores)

Seashore Oddities

(fascinating animals along Monterey Coastline)

Tidal Zone

(plant and animal life where river and ocean meet)

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SECTION VI

PLANTS AND ANIMALS ABOVE THE TIDAL ZONE

Plants Above the Tidal Zone

UNDERSTANDING

To discover the substances which make up soil and to compare soil from different area types. Soil is the surface layer of mineral particles and organic matter. It differs in composition according to parent rock, climate conditions, and the death and decay of organisms which inhabit the area over a long period of time. Soil is a self-renewing process; rock particles combine with organic materials, living organisms, air and moisture. Usually, it provides the essentials for young plant life.

BACKGROUND INFORMATION

Film: Soilmakers

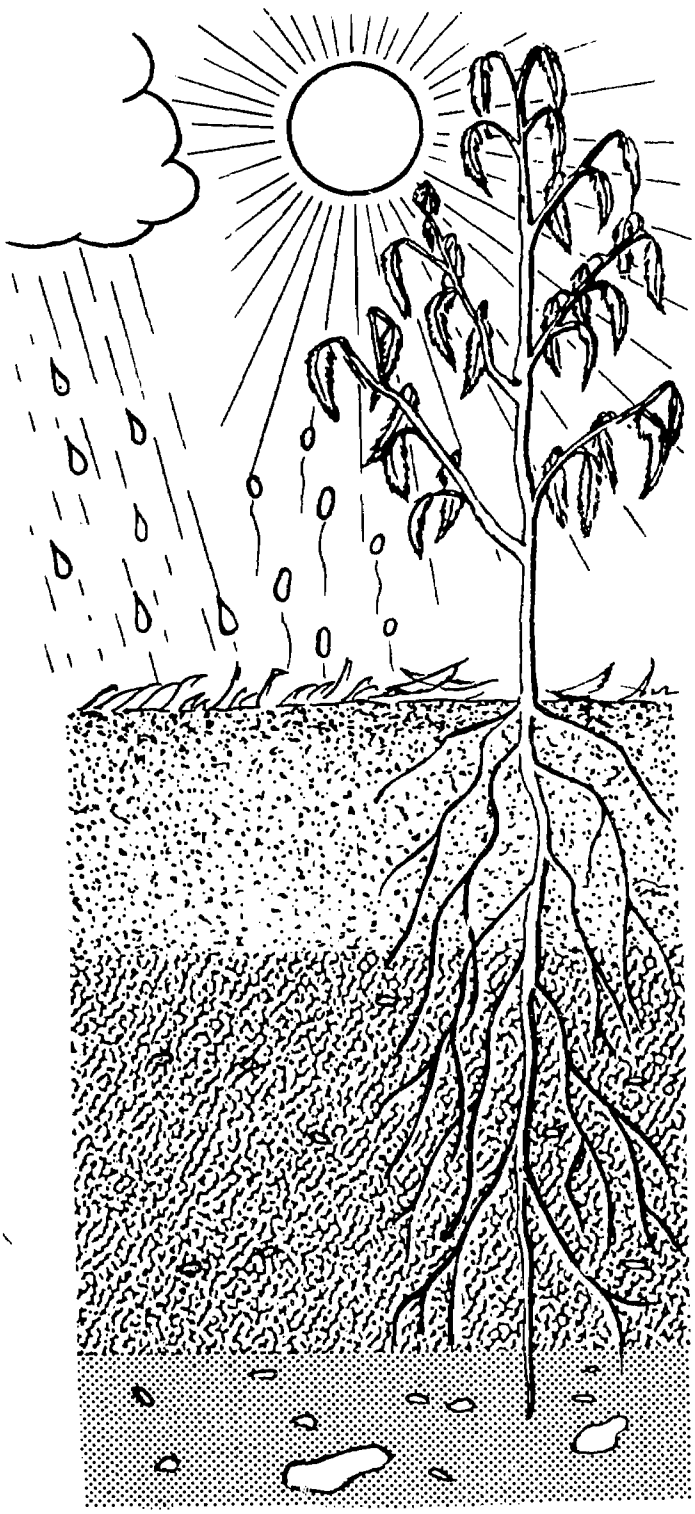
ACTIVITIES

1. Ask the question "What is soil?" Elicit responses before distributing sheet titles "What is Soil?" Then ask the question again.
2. Visit two different areas of Camp Casey and study the soil. (Consider the forest, grass areas, or beach above the tide zone.)
3. Study soil closely by probing with pencil or hands, examining the composition of each.
4. Discuss the particles they might find in each sample that make up the soil.
5. Complete work sheet #1.

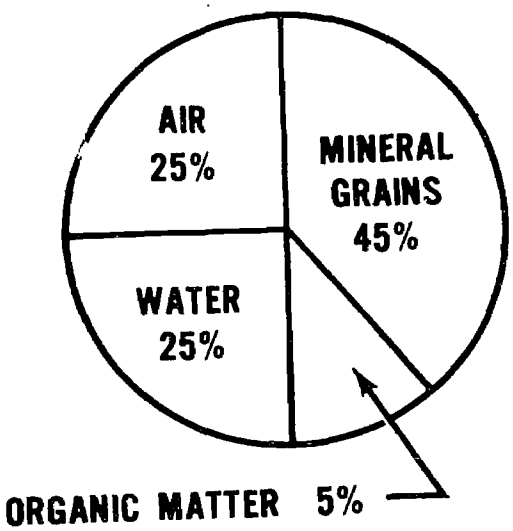
REFERENCES AND MATERIALS NEEDED

1. "What is Soil?"
2. Work sheet #1 "Soil Composition Study"

WHAT IS SOIL?



- - A SELF RENEWING COMPLEX OF LIVING MATERIALS - ROCK PARTICLES COMBINED WITH ORGANIC MATERIAL, LIVING ORGANISMS, AIR AND MOISTURE - - -



- - - ESSENTIAL TO LIFE ON EARTH, THE SOIL'S ABILITY TO SUPPORT THAT LIFE CAN BE DESTROYED BY IMPROPER CARE

Soil Composition--For Plant Growth

Student Worksheet #1

Name_____ Date_____

Examine soil from two different areas. Closely examine the soil and list different particles you can find in each sample. On the back of this sheet, sketch living plants and animals found.

Sample 1

Type of area (describe)_____

Particles found

_____ _____ _____

_____ _____ _____

_____ _____ _____

Sample 2

Type of area (describe)_____

Particles found

_____ _____ _____

_____ _____ _____

_____ _____ _____

What particles did you find in sample 1 that were not found in sample 2?

_____

_____

What particles did you find in sample 2 that were not found in sample 1?

_____

_____

Why do you think there were different kinds of particles in the two samples?

_____

_____

UNDERSTANDING

All plants are born, grow to maturity, and die. They live in communities with many other plants and organisms in always changing environments.

ACTIVITIES

1. Locate a rotten log to examine and relate it to activity 1 and the decomposition process.
2. Distribute worksheet #1 "Study of a Rotten Log"
3. Distribute worksheet #2.

Study of a Rotten Log

Worksheet #1

Name_____ Date_____

Would you believe.....that plants can live on and in wood
.....that a rotten log is really alive?

All plants are born, grow to maturity and die. They live in communities with many other plants in always changing environments. With your class, go to a rotten log (or stump) and find out all you can about it. Take care not to tear it apart so others can enjoy it, and so the living things in and on the log will still survive.

How did this log (stump) get here? _____

_____

Where is the stump (or log) of the tree? _____

What kind of tree was the log when living? (Look at bark and wood structure) _____

_____

How did the tree die? (Notice stumps of other trees in area.) _____

_____

When did it die? (Determine age of standing tree in area.) _____

_____

How old was it when it died? (Count rings on stump if possible.) _____

Record evidence of plants living on or in log: (lichen, mosses, fungi, broadleaf and conifer plants)

Name	Location (top, side, inside, under)	Seed Source	Effect on Log	Benefit to Forest Community

What do plants need to grow?_____

_____

How do plants get things from the log?_____

_____

Worksheet #1 (Continued)

Why do we call rotten logs "nurse logs?" _____

_____

Record evidence of animal life in or on this log

Name	Location (top, side, inside, under)	Source	Effect on Log	Benefit to Forest Community

Why do they live here? _____

_____

What do they need to live? _____

How do animals get these things from the log? _____

_____

What will the log eventually become? _____

_____

What things help to decay the log? _____

How does this log help soil hold water? _____

_____

How does this log reduce soil erosion? _____

_____

How does this log help new plants to grow in the plant community? _____

_____

_____

How does this log illustrate the principle: "Matter is neither created nor destroyed, but only changed from one form into another?" _____

_____

_____

_____

_____

Study of Rotten Log

Worksheet #2

Name _____ Date _____

A Rotten Log

What species of tree was it? _____

Where is the stump? _____

How did the tree die? _____

List living things in or around the log.

Name	Location on Log	Seed Source	List good or bad

How is this log useful to: Soil _____

Water _____

Plants _____

Animals _____

Man _____

UNDERSTANDING

Most trees obtain their food and energy for growth in similar ways.

BACKGROUND INFORMATION

Relate the importance of the soil to the growth of a tree--see charts from activities 1 and 2.

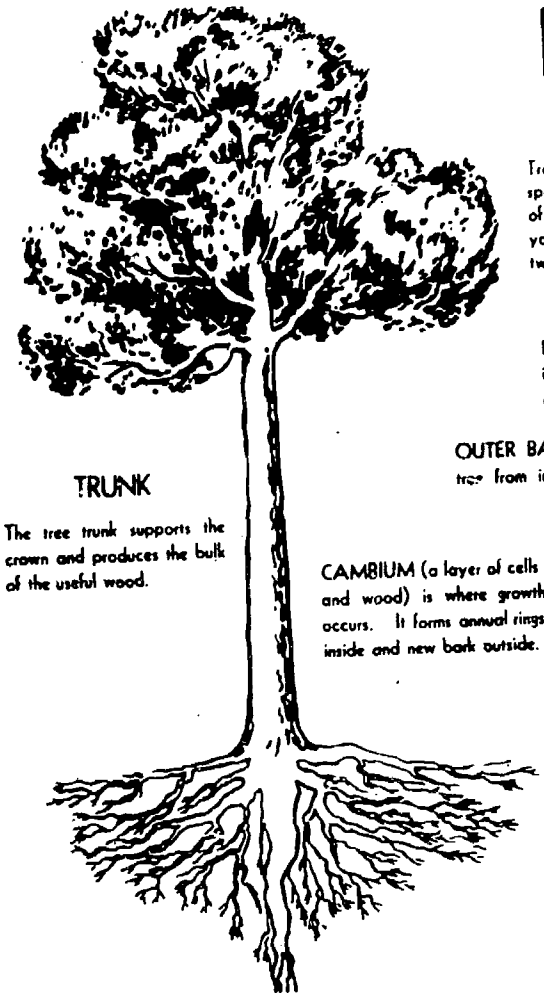
ACTIVITIES

1. Distribute "How a Tree Grows," and "How Fire Ruins Timber."
2. Discuss the parts of a conifer tree, then try to locate a young one to determine its age by counting the number of levels (about a foot apart on young trees), that the groups of branches extend from the trunk. Each level represents approximately one year's growth.
3. Let students practice determining the age of small trees close by.
4. Then ask, "How would you tell the approximate age of a larger tree?" See activity "How old is a tree?"

REFERENCES AND MATERIALS NEEDED

1. "How Fire Ruins Timber"--reference for "How a Tree Grows" to provide a more detailed diagram of the outer bark, inner bark, cambium, sapwood, and heart wood.
2. Navarra and Zafforoni, Today's Basic Science, Chapter 6.

HOW A TREE GROWS



TRUNK

The tree trunk supports the crown and produces the bulk of the useful wood.

ROOTS

Roots anchor the tree; absorb water and dissolved minerals and nitrogen necessary for the living cells which make the food; help hold the soil against erosion. A layer of growth cells at the root tips makes new root tissue throughout the growing season.

CROWN

Trees increase each year in height and spread of branches by adding a new growth of twigs. This new growth comes from young cells in the buds at the ends of the twigs.

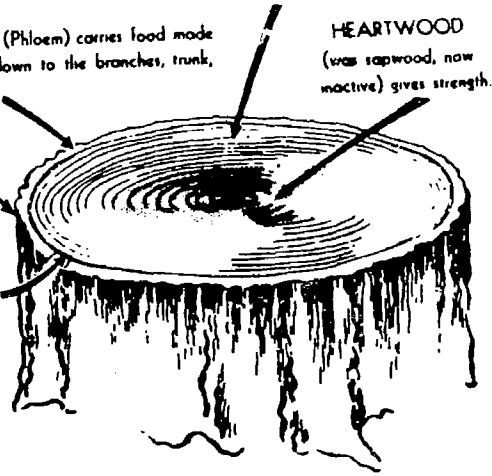
SAPWOOD (Xylem) carries sap from roots to leaves

INNER BARK (Phloem) carries food made in the leaves down to the branches, trunk, and roots.

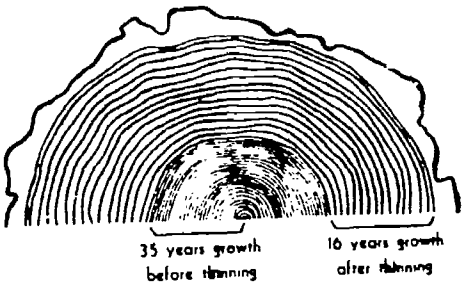
HEARTWOOD (was sapwood, now inactive) gives strength.

OUTER BARK protects tree from injuries.

CAMBIUM (a layer of cells between bark and wood) is where growth in diameter occurs. It forms annual rings of new wood inside and new bark outside.

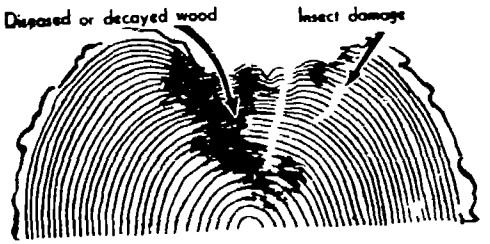


THINNING INCREASES GROWTH



FIRE RUINS TIMBER

Disease and insects enter through fire scars



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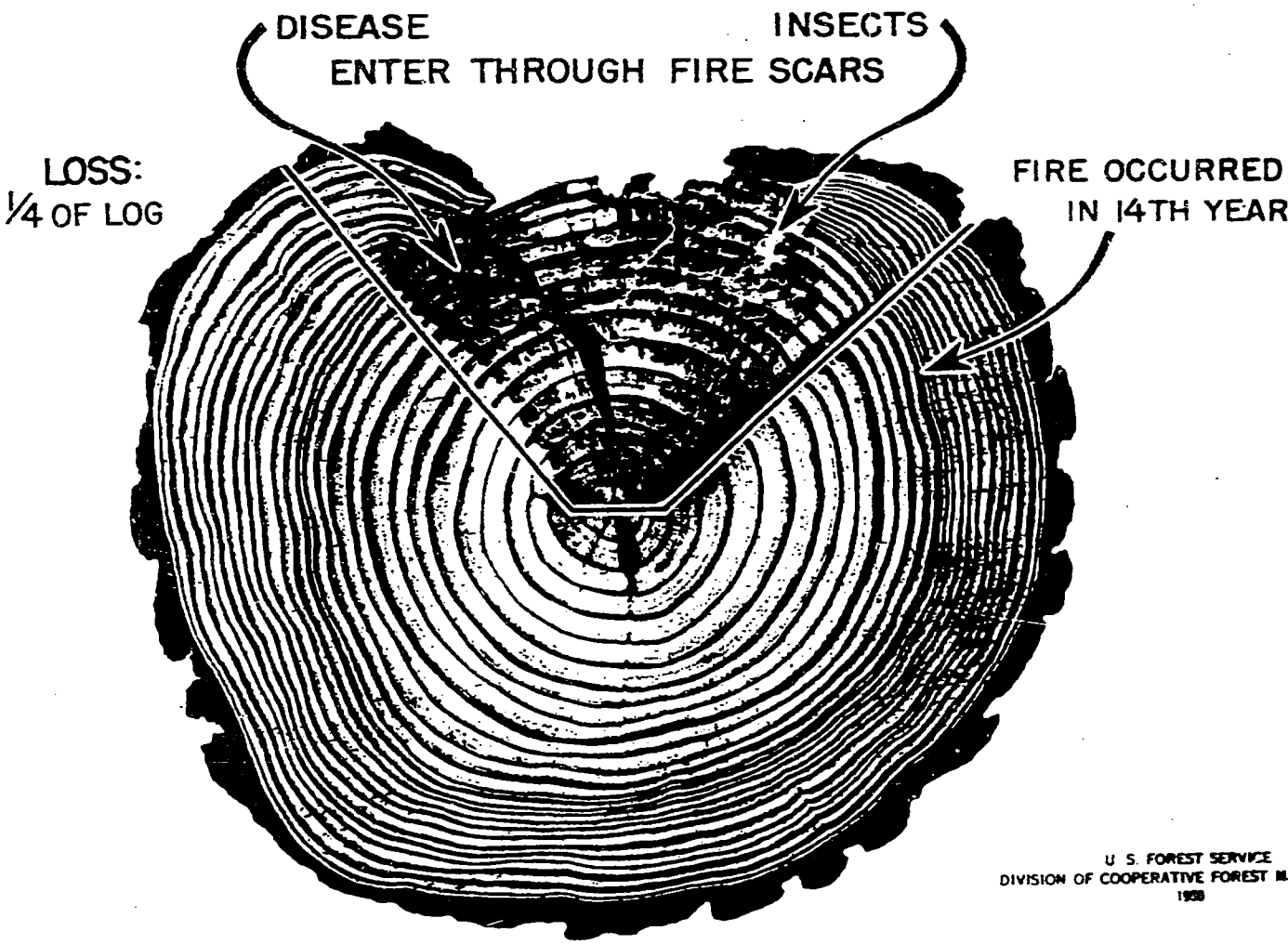
HOW FIRE RUINS TIMBER



U. S. FOREST SERVICE
DIVISION OF COOPERATIVE FOREST MANAGEMENT
1958

THE RESULT OF ONE FIRE

Wood destroying rot and insects entered through the fire scar. The defect in the tree is permanent. The more intense fires also kill some trees outright, and slow down the growth of others by killing part of the green foliage.

UNDERSTANDING

How old is a tree? All trees make some growth each year. Some grow very rapidly while others grow very slowly. The annual growth is made not only in height, but also in diameter.

ACTIVITIES

1. Try to locate a fallen tree or log to determine how old it was when cut.
2. Use the sheet "How Old is That Tree?" to provide background information. Provide one for each student.
3. If available, use an increment borer to determine the age of a tree. See the sheet "The Increment Borer" for more information.

MATERIALS NEEDED

Increment Bore

How Old is That Tree?

All trees make some growth each year. Some grow very rapidly, some very slowly. The annual growth is made not only in height, but also in diameter.

We can count the growth rings on a stump of a tree to tell how old that tree was when it was cut. Many times foresters want to know how old standing trees are, how fast they are growing or to tell if they are rotten inside.

Here are three ways to tell the age of trees or tree stumps:

1. How old was this tree when it was cut?

   The current year's growth is the ring next to the cambium layer just inside the bark. The rapid spring growth is lighter colored than the growth made in the summer, so a light and dark colored ring makes one year's growth. It is easier to see and count the summer wood or dark rings to determine the age of the stump or a log of a tree when it was cut.

   These rings are easily counted on the stumps of cut trees.

How old was this tree when it was cut?_____ The dark rings are summer wood and the light rings are spring wood. One light and one dark ring makes one year's growth.

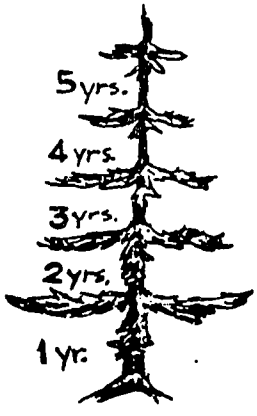
Find a tree stump in the forest and answer the following questions.

Problems:

a. Was this tree growing fast when it was cut?
b. How old was it?
c. What was the diameter of the tree when cut?
d. How tall was it? You can compare the size with live trees nearby or find the top of that tree that was left in the woods and measure the distance from the stump to the top.

2. How old are young trees?

Live trees always have a cluster of buds at the top of the tree. As growth begins, the center bud sends up vertical growth and the buds around the center bud send out a series of horizontal branches. This is repeated each year. The age of young conifer trees can be determined by counting the number of sets of whorls of these annual branches. Thus if we count 25 whorls of branches, the age of the tree is about 25 years. As the tree gets older, it is difficult to count the whorls.



Young Conifer Tree

Problems: If there are young conifer trees growing in an area that was logged, can you tell how long ago it was logged?

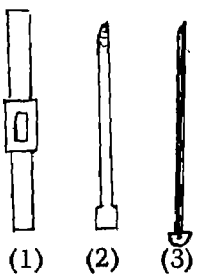
The farther apart the branches are on the trees the faster the trees are growing. Study young trees in different areas and compare growth rates.

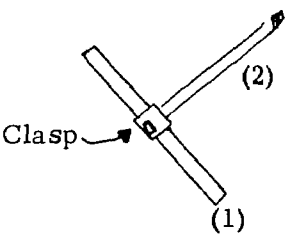
The Increment Borer

The most accurate method of determining the age or growth rate of trees is to use an increment borer. This instrument is a hollow wood-boring bit that cuts a core instead of shavings, as with a regular wood-boring bit. The increment borer has three parts. See diagram #1.

Unassembled

(1) Handle
(2) Auger
(3) Extractor





Assembled

(1) Handle
(2) Auger

(DIAGRAM #1)

Assembling the Borer

Unscrew the cap of the borer and pull out the extractor. Put the extractor in a safe place so no one will step on it. Tip the handle up and let the auger slide out into the palm of your hand. Be careful not to let the auger fall to the ground because it may chip.

Assemble the borer by inserting the square end of the auger into the square hole of the handle. Close the clasp so the auger won't come out.

Boring a Tree

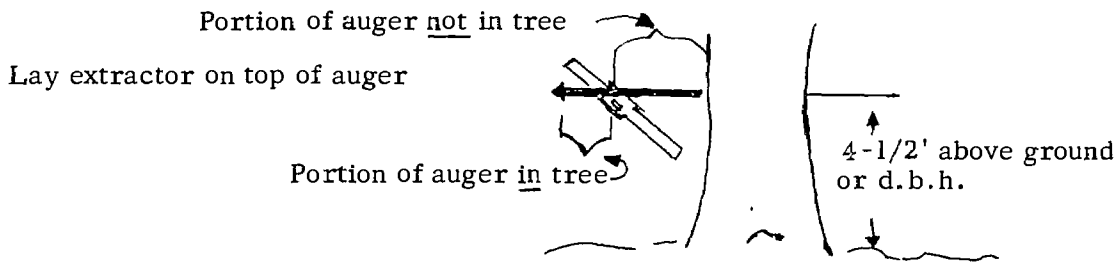
1. Hold the borer firmly against the tree at d.b.h. which is 4-1/2 feet above the ground. All trees are bored and the diameter measured at d.b.h. or diameter breast height. (Note: If you want to reach the center of the tree, be sure to select a tree whose radius is smaller than the borer.)
2. Point the auger toward the center of the tree and turn the handle until the bit of the auger starts to bore into the tree.
3. After several turns, stand back from the borer and see if it is going toward the center of the tree. Correct its course before it bites too deeply in the wood.
4. Continue boring until you think you have reached the center of the tree.

Checking How Far to Bore

Assume the tree trunk is round. The auger and the extractor are the same length.

1. Lay the extractor alongside the auger. The tip of the extractor should touch the bark.

2. Grasp the extractor where it crosses the handle. The part of the extractor extending past the handle is equal to the distance the auger is in the tree. (See diagram #2.)

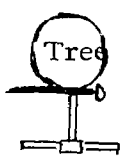


(DIAGRAM #2)

(Important! Remember, the auger and extractor are the same length.)

3. Still holding the extractor at the place where it crossed the handle, place it against the tree, parallel to the handle, with your hand on the auger. (See diagram 3.)

If the part between your hand and the head of the extractor extends past the edge of the tree, you are probably past the center. If it does not extend past the tree, you must bore in further.



Measured Extractor shows auger is not past center

Measured Extractor shows auger is past center

(DIAGRAM #3)

An alternate way of doing this is to measure the diameter of the tree with a diameter tape and mark 1/2 the diameter on the auger with a grease pencil. Bore into the tree to the grease pencil mark.

Extracting the Core

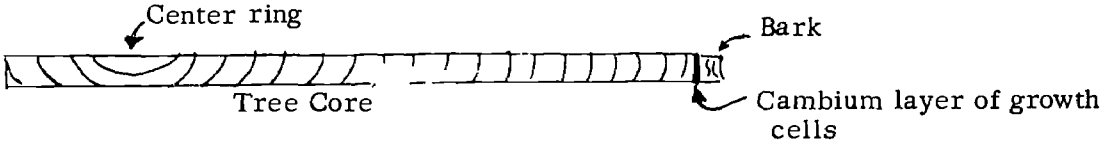
Once you have reached the center of the tree, you are ready to extract the core.

1. Insert the extractor into the hole of the auger. As you push it in, lift the end of the extractor gently so it will go under the core easily. Push it all the way in.

2. Unscrew the whole borer one full turn.
3. Pull the extractor out of the auger in a straight line.
4. Remove borer from tree.

Determining the Age

One springwood ring and one summerwood ring together make one year's growth. Count the summerwood or dark rings to determine age of tree. Growth rings closer to the center of the tree are more slanted than those on outside edge.



(DIAGRAM #4)

(Important: The ring count is age at d.b.h. It takes several years for a tree to reach d.b.h. Add the following years to ring count for total tree age: Douglas-fir 8, pine 11, hemlock 7, spruce 7, true-firs 8, cedar 7, alder 2.)

Care of the Borer

Here are a few suggestions to follow in the use of the borer.

1. Don't bore into knots or gnarled trees. The auger bit may chip.
2. Don't force the extractor into the borer. Forcing it may compress the wood core, making it difficult to clean and may break the extractor. (If wood is jammed in the auger, take it to an engineering repair shop to have it removed.)
3. Don't poke any objects down the cutting end of the auger; it may chip the bit.
4. Don't bang the borer on rocks or wood.
5. If the bit is dull, chipped or the extractor becomes broken, take it to an engineering repair shop to be sharpened or repaired.

Instructions for Cleaning

Be sure to clean and oil the borer after each use. Make a cleaning kit of: small can of penetrating oil; two small rags on pieces of thin wire, one for cleaning, one for drying; pad of steel wool; large, clean rag for wiping auger and extractor.

1. Rub down the auger and extractor with steel wool and penetrating oil. Wipe with clean cloth.
2. Pull a small piece of cloth saturated with penetrating oil on a wire or string through the barrel of the auger.
3. Dry the inside by pulling a small dry piece of cloth through the borer. Wipe the whole borer dry.
4. Soak in gasoline overnight if the borer is sticky with pitch or grease.

UNDERSTANDING

All plants (trees) have certain individual characteristics that are unique and different from others. The individual characteristics are used as a guide for identifying deciduous and conifer trees.

BACKGROUND INFORMATION

Show the following films, if available:

1. Conifer Trees of the Pacific Northwest (Available from King County Film Library.)
2. Trees, How We Identify Them (174) Coronet Instructional Films, 1958.

ACTIVITIES

1. Ask, "Do you know how to tell that one tree is different from another?" Bring out the fact that all trees have individual characteristics.
2. Pass out "Tree-Clue Chart" and discuss each section on the chart to bring out its meaning. Go through the sample on the vine maple, then take a short walk and let them sketch the characteristics of trees.

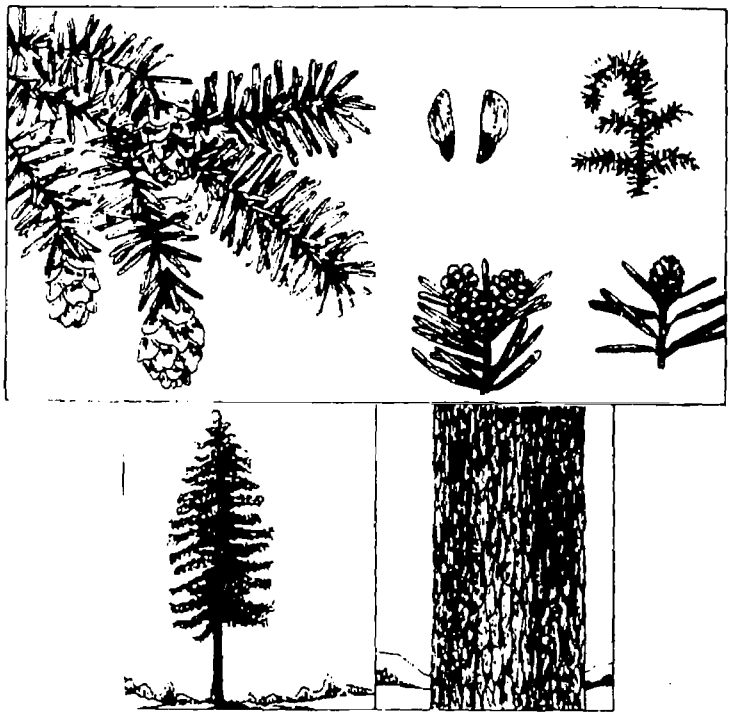
   Included in this section is a guide to five (5) species of trees common to the Camp Casey site.

REFERENCES AND MATERIALS NEEDED

1. Worksheet "Tree-Clue Chart"
2. Phillips, Donald C., "The Vascular Plants of Camp Casey, Whidbey Island, Washington," Journal of the Institute for Research, Seattle Pacific College, 1969, p. 25.

Tree-Clue Chart Sample

Shape	Leaves	Bark	Flower	Fruit	Distinctive Characteristics	Name
	 7-9 blunt lobes	Smooth dull-brown to pale-green		 3/4" - 1-1/2"	Crooked branches Like vines	Vine Maple



WESTERN HEMLOCK
Tsuga heterophylla (Raf.) Sarg.

Leaves are scattered singly on twigs and are usually arranged in flat rows on each side of the twig, about 1/4 to 3/4 inch long and 1/16 inch wide, on short petiole (leaf stem), rounded at apex, dark green and shiny above, marked below with white bands of stomata.

Buds are rounded, light brown, about 1/16 inch long.

Twigs are first light brown then reddish-brown, and hairy for several years.

Bark is dark brown tinged with dark red, divided into broad flat ridges with scales; thinner than that of Douglas-fir.

Fruit is a pendent cone, ovoid-oblong, 1/2 to 3/4 inch long, and light brown.

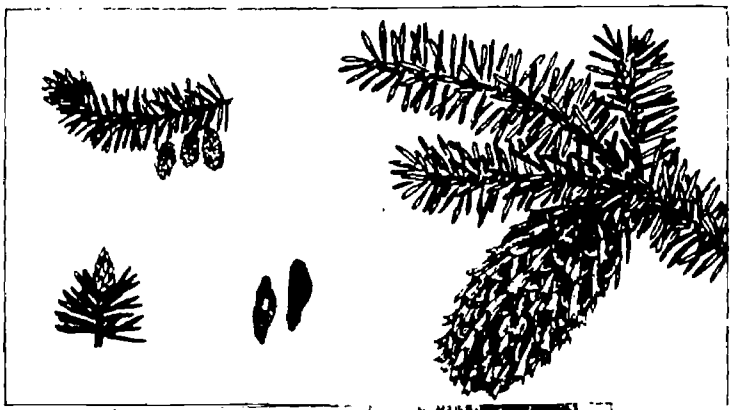
Wood is yellowish-brown, light, and hard.

It is a large tree, 125 to 175 feet tall, 4 to 6 feet in diameter, and forms a short pyramidal crown with a drooping leader.

It grows best on moist, humus soils and an abundance of atmospheric moisture is helpful; also grows well in the shade.

We find it west of the Cascades and in northeastern Washington.

Important characteristics are single needles on the twig arranged so the branch has a flattened appearance. Woody leaf bases remain when the leaves fall.



DOUGLAS-FIR

Pseudotsuga menziesii (Mirb.)

Franco

Leaves are scattered singly over the twigs, often in rows on opposite sides of the twigs, about 3/4 to 1-1/4 inches long, about 1/16 inch wide, and mostly blunt at the apex, yellow-green or blue-green.

Buds are shiny brown, sharp-pointed, about 1/4 inch long.

Twigs are slender and hairy for the first few years, yellowish at first and later becoming a dark gray-brown.

Bark is smooth on young stems, dark gray-brown, and often has resin blisters. It later becomes thick, reddish-brown, and is divided by deep, irregular fissures. Layers of light colored, corky material are mixed with the reddish-brown.

Fruit is a cone 3 to 4 inches long, oblong-cylindric, pendent, with three-lobed bracts longer than the cone scales.

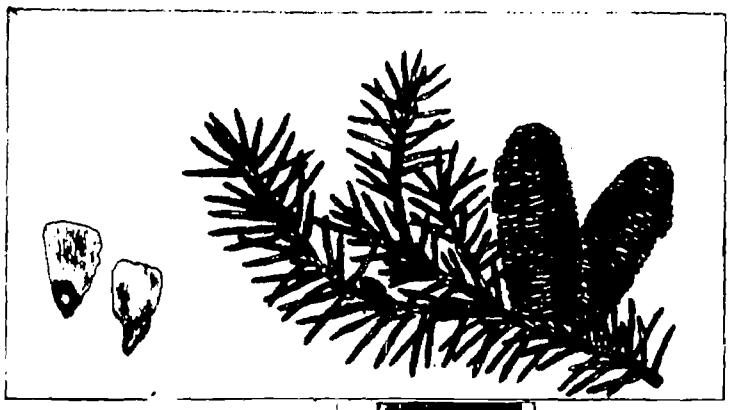
Wood is light red or yellow, hard, and strong.

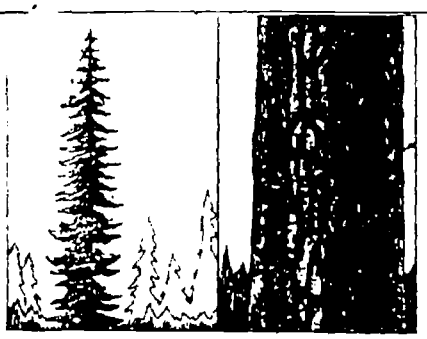
It is a large tree, often over 200 feet tall, and up to 15 feet in diameter; usually having a narrow, flat-topped head in a forest stand.

It grows on a variety of sites including some of the driest. But growth is best on moist, rich soils.

We find it in all forested sections of the state.

Important characteristics are needles single with a twisted stem, shiny brown, sharp-pointed buds, cones with three-lobed bracts extending beyond the cone scales.





GRAND FIR

Abies grandis (Dougl.) Lindl.

You often mistake me for Hemlock, but my needles are longer.

Leaves are scattered singly on twigs, 3/4 to 2-1/4 inches long, usually in two rows along the sides of the twig; dark green, marked on the lower side only by white bands of stomata.

Buds are nearly round, yellow-brown, about 1/4 inch long, usually resinous.

Twigs are slender, brown, and slightly hairy at first.

Bark is grayish-brown, smooth on young stems, becoming deeply divided into flat ridges. Resin blisters are present on smooth bark. It is purplish-brown in cross-section.

Fruit is an upright, cylindrical cone, 2 to 4-1/2 inches long, greenish-purple. Cone scales fall off at maturity.

I grow with my cousin Douglas at sea level.

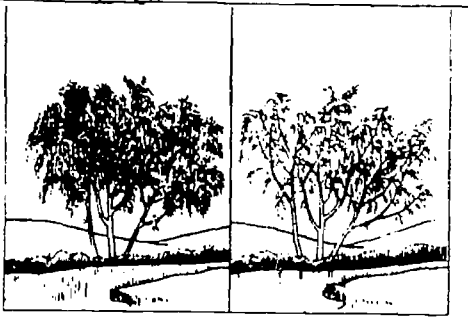
Wood is pale brown, soft, and light.

It is a large tree, 140 to 170 feet tall, 2 to 4 feet in diameter, and grows on better sites, forming a rounded head.

It grows most commonly on deep, moist soil from sea level to 7,000 feet.

We find it in all of the state except for the central eastern part.

Important characteristics are needles single, arranged on the twig to give a flattened appearance, the cone is upright.



WILLOWS

Salix species

Leaves are alternate, usually lanceolate (long and narrow) to elliptical (oval or oblong), commonly with no stalk or only a short one, leaf margins run from entire to coarsely toothed.

Buds are not terminal buds, lateral buds appressed to stem with a single cap-like scale.

Twigs are all variations of sizes, colors, and hairiness.

Bark is smooth, greenish-gray, when young, usually darker and furrowed in old trees.

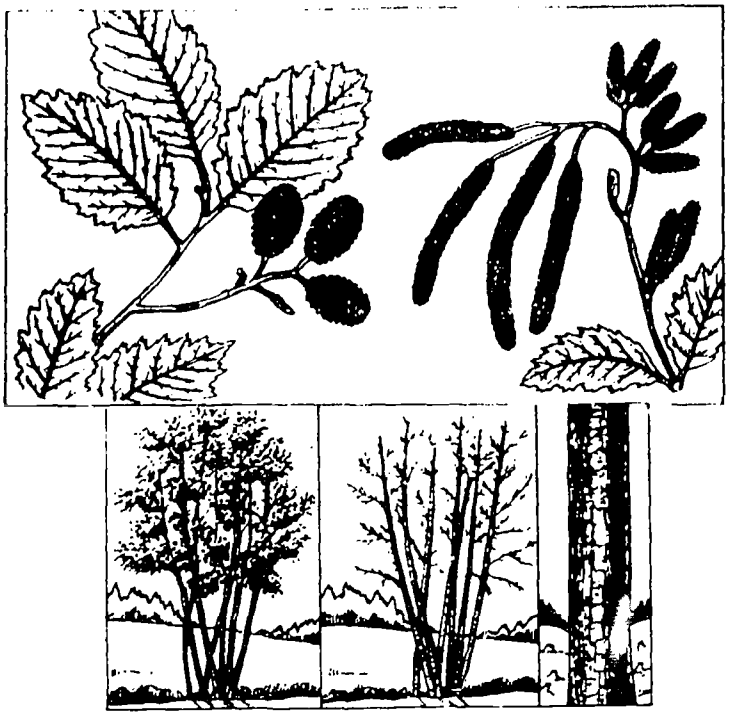
Fruit is capsule born in an ament (catkin).

They grow as shrubs to small trees.

They are most commonly found in moist or wet areas close to streams, lakes, or swampy places.

We find the several species scattered over the entire state.

Important characteristics are alternate lanceolate (lance-like) leaves, single, cap-like bud scales, mostly shrubby in form.



RED ALDER
Alnus rubra Bong.

Leaves are alternate, simple, ovate-elliptical, serrate-dentate with small gland-tipped teeth, rusty hairs on principal veins below, dark green and without hair above, wrinkled, 3 to 5 inches long, 1-1/2 to 3 inches wide.

Buds are about 1/3 inch long, dark red covered with scale-like hairs.

Twigs are usually slender, round or slightly three-angled, bright red to reddish-brown.

Bark is a grayish-white to bluish-gray, smooth or with tiny waxy growths; irregularly-plated on older trees; inner bark bright red-brown.

Fruit is an oblong to rounded, pendent cone, 1/2 to 1 inch long, circular nutlets.

Wood is light brown tinged with red, light, soft, weak, and brittle.

It is a tree from 80 to 130 feet tall, often only 30 to 50 feet tall, 10 to 36 inches in diameter. It develops a shallow, spreading root system and a narrow crown.

It grows best on moist rich bottomlands and lower slopes or damp beaches. It often forms dense stands and is one of the first trees to appear after a burn or logging operation.

We find it extending from the coast to the Cascade Mountains.

Important characteristics are alternate, simple, leaves; smooth grayish bark; fruit in a small cone.

UNDERSTANDING

Trees in a new growth form a dense stand. Mature trees form a more open forest.

ACTIVITIES

1. Pace off and outline with a string a 50-foot square in a forest of new growth. Have each student count and record the number of trees. Repeat in a more mature forest. Discuss possible reasons for the greater density in the younger growth. Discuss possible effects on other forms of life.

UNDERSTANDING

Compared to a mature stand, a new growth of trees permits little undergrowth.

ACTIVITIES:

1. Encompass a 10-foot square with a string. Several squares may be marked in the forest to accommodate more students. Have the students count the leafy plants in the square and record the number. Do this in a new growth and an old growth of trees.

2. Compare the counts and discuss possible reasons for the differences.

UNDERSTANDING

Insects attack living and dead plants in the forest.

BACKGROUND INFORMATION

Forest dwelling, plant-eating insects.

ACTIVITIES

1. Have children examine leaves on shrubs and smaller plants for holes indicating possible insect attack. Make a count. (Each student.)

2. Examine the bark of living and fallen trees for small entrance and exit holes of bark beetles, sawflies, etc. Discuss extent of the damage and possible effect.

3. Remove a portion of loose bark from a fallen tree. Note castings and burrows of insect larvae. Discuss the patterns formed. Replace the bark.

UNDERSTANDING

Forest debris decomposes into soil.

ACTIVITIES:

1. Have children observe and describe the changes in leaves, limbs, and trunks as they decay. Find evidence of small and large fungus attacking the debris.

With a shovel, make a clean section through the duff into the soil. Find and describe evidence of fungus and bacterial decay. Note evidence of the decayed matter blending into the soil. Attempt to explain different colors of the soil layers. Replace the material in the hold.

UNDERSTANDING

Man disturbs the environment.

ACTIVITIES

1. Along the trail, have each child keep a record of evidence of man's having disturbed the environment. Note such evidence as tree cutting, clearing, road grades, abandoned materials. (Take a peek under these discarded materials and buildings.)

REFERENCES

The Forest, Life Magazine, 1961.
Russell, Trees for Tomorrow. Melmont Publications, 1958.
Hosmer, Now We're Logging. Binsford & Mort, 1930.
Zin, Trees. Golden Press, 1956.
Fenton, Trees and Their World. John Day Company, 1957.
Lyons, Trees, Shrubs and Flowers to Know In Washington. Dent & Sons, 1956.
Various current U. S. Forest Service publications

Films (Available from King County Library)

Wonders of Plant Growth

A Tree is a Living Thing

Filmstrips

Non-flowering Plants

Trees Around Us

Animals Above the Tidal Zone

UNDERSTANDING

Wildlife can exist in an environment which provides adequate amounts of food, water, and shelter throughout the year.

BACKGROUND

A web of life exists by which plants and animals derive nourishment from each other.

The energy for all life has its origin in the sun.

Animals eat plants and the energy is converted into heat and movement ("a web of life.")

Animals that may be found: moles, shrews, wood mice, bats, raccoons, skunks, fox, chipmunk, squirrel, rabbit, and deer.

ACTIVITIES

1. Students could describe evidence of animal life seen at the bog, beach, forest area, and meadow. Evidence would include:
   a. Tracks in sand or mud
   b. Signs of feeding
   c. Look for animal droppings
   d. Signs of burrowing
2. Students can pool information and reconstruct food chains. Pupils can chart several simplified food chains

Plant ------→ Rabbit ------→ Hawk

UNDERSTANDING

Insects make up a part of the balance of nature.

BACKGROUND

Insects make up the most abundant form of animal life on earth.

The most numerous are:

1. Coleoptera (beetles)
2. Lepidoptera (butterflies and moths)
3. Hymenoptera (wasps, bees, and ants)

ACTIVITIES

1. Collect a sampling of insect life from various areas.
2. Count insects in a small measured-off area.
3. Collect various insect eggs.

Creative Activities: Art and Language Arts

The activities that follow are suggestions for you to consider for possible lessons at Camp Casey.

These lessons deal with creative dramatics, creative writing, and art concerning plants and animals above the tidal zone.

You may want to plan to use one or two of these specific activities.

Refer to the guide, Interdisciplinary Outdoor Education, published by Shoreline Public Schools, for additional activities. Each school has a copy available.

UNDERSTANDING

Stone paperweights can be made by using tempera paint on smooth round or oval stones.

MATERIALS

Smooth oval stones suitable for paperweights, shellac (or enamel), tempera paint, small brushes.

ACTIVITIES

1. Each child should collect one smooth stone. Point out to the children how beautiful the stone is itself in coloring and in shade. Let each child examine the lines and designs suggested by the surface variations of the stone. Let each child follow the shapes of the surface variations of his stone with his finger. Wash and dry a smooth stone. Experiment with the shape to determine how it rests best on a flat surface. The painted designs or pictures should be suited to the shape and the size of the stone. A few lines, spots, or small areas may be painted to follow the surface variations, or highlight the natural color. The entire stone may be painted. The stones should dry thoroughly. After the stones have dried, a shellac should be applied to the entire stone. (This could be done after returning to your school.)

2. Enjoy and admire each other's painted stones. Let each child tell orally what his stone represents. Give the painted stone to someone as a gift.

UNDERSTANDING

Painting outside allows for development of many techniques; subject matter need not be realistic representation.

MATERIALS

Water, bucket for the water, watercolors, water containers, paint cloths, paper (white, manila), brushes, lap boards, turpentine and linseed oil, crayons, pencil.

ACTIVITIES

1. Show paintings to the class which might stimulate a discussion about the sea. Show the class the "Northeaster" by Winslow Homer. Show the class the "Storm" by Henry Mattson.

   Discuss other objects which might be included in the paintings: trees, plants, flowers, birds, water, clouds.

2. A watercolor transparent painting can be done successfully outside. Use water colors to create a drawing or design. Emphasize imagination and art quality rather than true representation.
   a. Light, quick strokes keep the color clean.
   b. Rolling, turning or twisting the brush gives a cloud effect.
   c. Use the point of the brush for a thin line.
   d. Use the broad side of the brush for thick lines.
   e. Review dark, light, cool, and warm colors.

   Have the children build the composition as they paint. A transparent painting can be produced when the drawing or design has dried. If a stained glass window effect is desired, paint black outlines around each color. Mix one part turpentine and two parts linseed oil together. Apply the mixture to the back of the painting with a brush or rag.

3. Crackled paper crayon-resist can be done successfully outside. Make a light drawing in pencil on manila paper. Follow the pencil lines with crayon. Crumble the paper into the smallest possible ball. Smooth out the paper. Using watercolors, paint over the entire paper. Use a dark watercolor wash when using light color crayons. Use a light watercolor wash when using dark color crayons. The paint will cover the uncolored paper and resist the wax crayon. A web-like pattern will appear.

UNDERSTANDING

A nature collage is a picture or design made of a variety of materials taken from nature to which the artist adds lines and colors of his own.

MATERIALS

Poster paper (or cardboard), paint (tempera or watercolors), crayons, chalk, quick-drying glue, stapler, scissors, collection of materials, lacquer, brushes (for paint and lacquer).

ACTIVITIES

1. Collect natural materials for the collage: leaves, seeds, feathers, pine cones, small twigs, parts of nuts, shells, soil and sand, tiny rocks, dry grass, dry pine needles. Identify and talk about the materials collected. Discuss how contrasts help make better designs. Discuss how nature itself is a wonderful designer. Tell the students they will use the collected materials to make a design or picture of their own. The completed project will be called a collage.

   Arrange the collected items into an interesting design or picture.

   Paste, glue or staple the items on a cardboard background. When the items are all secure, lines and color may be added with crayons, chalk, or paint. A clear lacquer might be applied for a more finished look.

2. Analyze the collages in terms of art qualities. Is the background darker or lighter than the foreground? (contrast) Are the mounted items of many different sizes? (variety) Do all the colors go together? (harmony) Are there rough and smooth surfaces? (texture) Are the objects similar in shape? (unity) Do you like the way the collage looks as a finished product? (appreciation)

UNDERSTANDING

After a study of trees and their uses, tree silhouettes can be sketched with India ink or charcoal.

MATERIALS

India ink, brown and green watercolor, brush or pen, tag board.

BACKGROUND INFORMATION

The main features of a tree should be discussed. Consider other tree parts which might make a silhouette: blossoms, fruit, wings, cones. During a nature walk, point out the various sizes of branches which reach out, spread, and cross one another, and the repeated shapes of leaves.

ACTIVITIES

1. Sketch a tree or leaf from the sample with ink or charcoal. After the sketch has dried (if ink is used) shade with brown and green watercolor. Follow the lines or use a wash effect. Label the sketch with a pen or brush and ink.

UNDERSTANDING

Reinforce in one's own mind the new information students have learned about trees. Write a conversation that you might have just as one might talk to their horse, dog, or cat.

BACKGROUND INFORMATION

Encourage students to consider some of the things discussed about plant life that would be appropriate to ask a tree. Encourage them to write in conversation form using a new paragraph each time one talks. Encourage communication of feelings and impressions.

ACTIVITIES

1. Pick a tree close by, one that you like, and sit down by it as if you were planning to carry on a conversation with it.
2. Use a blank sheet of paper for writing.
3. Ask the tree such questions as: "How long have you been living here?"
   "I know your name, can you guess mine?"
   "How come some of your branches are broken off on one side?" (wind storm)
   "Why is your bark so rough/smooth?"
   "Do you like your neighbors who seem to be crowding in on you?"
   "What do you think they will do with you when you become fully grown?"
   "What kinds of activities does he enjoy the most?" (Having visitors run up and down in his branches, or just watching the kids at Camp Casey.)
4. Draw a picture of your tree on the back side of the paper and name it by its real or imaginary name.
5. Engage in activities as described above encompassing wind, water, soil, and rocks.

UNDERSTANDING

Student writing can include description based on nature observation, personal experience and creative imagination.

BACKGROUND INFORMATION

The teacher may display pictures without explaining them, or the children may be instructed to write a story about the picture of their choice. Children can project their feelings to other objects more easily than writing about their own personal thoughts or emotions; theref greater success will be realized by writing about a fictitious person or animal.

Generally, it is well to limit stories to two pages on one side only. This inhibits rambling and forces the writer to organize. Some children will write several chapters only because they don't know how to end the story. One preliminary technique is for students to picture an exciting situation such as animals running before a forest fire or two children in a canoe escaping the swift current of a river. Have them use this scene as the ending for the story and then go back and write up to this event.

It is well to remember that the best writer is not always able to sit down at a given moment and write well. What are some ways to get the needed responses?

1. Develop an informal, friendly atmosphere. Tell a joke or story about camping, hunting, or fishing; use dialect or role-playing to enrich the telling. The story should be believable and fit the age group. Intermediate age children like mystery, animals, humor; all of these may contain tender moments. Observe student reaction closely; when interest is high, pass out the paper.

2. Suggest a phrase or just one word such as: "A premonition of impending danger . . . Fire! Lost! Avalanche! A Bear!" These may be used as titles or the class may be invited to build on them.

3. Describe a camping situation wherein the fragrance of bacon or some favorite food is mentioned. This will create consciousness of the fact that language can trigger a physical response, such as hunger.

4. Read or discuss Indian legends. Then have students write their own legends with titles such as, "How the Bear Lost His Tail," "Why the Ocean Roars," etc.

ACTIVITIES

1. Write a story about a person or animal in a natural setting.
2. Record in vivid, descriptive writing a word picture of a chosen outdoor location. Make careful observations of natural objects and their characteristic details. Embody your own reactions and feelings about the place.

UNDERSTANDING

Haiku is an expression of emotion stimulated by the poet's observation of some aspect of the world around him.

BACKGROUND INFORMATION

The teacher should be familiar with Haiku as an art form.

The Japanese invented haiku about 700 years ago. Although the form uses only three lines, they are packed with observation, feeling, and thought.

The earliest Japanese haiku date from the 13th century, but the form did not become popular until the 17th century. Matsuo Basho, born in 1644, is considered Japan's greatest haiku poet. One of his most famous poems was written while the poet was sitting in a garden with some pupils when a frog jumped into a nearby pond. He translated the experience into this poem:

Old pond:
frog jumped in,
water-sound.

Today haiku are immensely popular in Japan. At least a million verses are published each year in the fifty-odd monthly magazines devoted to them. Not only does Emperor Hirohito personally award prizes to winners of haiku contests; he writes haiku of his own.

The popularity of haiku is not limited to Japan, however. They have become popular in America, also. In traditional Japanese form each poem must have seventeen syllables, five in the first line, seven in the second, and five in the third. Because syllables in English are different from those in Japanese, original American haiku need not stick to the formal pattern. The lines may rhyme or not--however the poet wishes.

The teacher may read (or tell) the background material if he feels the group is lacking in this area.

Have you ever looked at something and felt a surge of emotion? It might have been a wave falling on a lonely beach or your school deserted for the summer. It may

have been any number of things if you are a sensitive person, aware of life around you.

The emotion you experienced was suggested by the thing you saw, something probably not big or flashy but one of the "everyday small things."

Suggestion is part of haiku. These poems do not say "I feel sad" or "The world is bad" or "Isn't life wonderful"; they usually describe an event without commenting on it. You, the reader, are left to "fill in" the emotion surrounding the event. You must, therefore, bring some of your own sensitivity--some of your knowledge of life--to the poem.

Study this example carefully.

On a withered branch
a crow has settled--
autumn nightfall.

Give the students a few moments to think about this poem. Then indicate what the poet has done: He has compared an autumn night to a large black crow settling slowly over the landscape. The mood created is one of sadness. Most of us experience moments of sadness in the fall as we remember the joys of long summer days.

Haiku are extremely delicate and subtle. Changing even one word may change the whole meaning. Look at this example.

Winter sprawls on the land.
Under its gray back
seeds lie still.

Mood? Again sadness--winter rules the land, even the seeds are crushed under its gray weight. Now change two words:

Winter sprawls on the land.
Under its gray back
seeds crouch.

Mood? Winter grips the land, but there is the promise of spring--seeds waiting to burst into new life.

What is the mood of the following haiku? Can you change the mood by changing one or two words?

Winds scream at my window.
My fire replies
laughing with flames.

ACTIVITY

1. When having the students attempt their writing you may simply call attention to curr ' 'weather conditions or seasonal changes. An imaginative teacher will . ave no difficulty providing his students with writing stimuli for this type of activity.

   Students write their haiku.

2. Some of the students may want to copy their poems on good paper. These copies may then be displayed on a bulletin board built around an Oriental theme. Some type of recognition must be given the students' efforts.

UNDERSTANDING

Speeches before and after visiting the site can provide exposure of student attitudes and responses.

BACKGROUND INFORMATION

This speech activity is based upon the concept that personal attitudes affect behavior and that attitudes are modified by interaction with others. The human organism tests values and ideas by verbalizing them in the presence of others. The response of the listener often is the criteria of value for the speaker.

Those who have responsibility for the success of field trips are concerned about the attitudes of the groups participating. Presenting the class with an opportunity to talk about what should be expected from them, the trip, and the group leaders may bring out attitudes, both desirable and undesirable, prior to the trip.

ACTIVITIES

1. The topics of first speeches to be given before the trip may be chosen which will bring out attitudes pertaining to group behavior such as:
   a. The Camper's Good Neighbor Policy
   b. Litter Bug
   c. The Age of Responsibility
   d. The Camp Goof-off
   e. How to Chop Your Foot
   f. No Purple Hearts at Whidbey

   In addition to these, speeches about anticipated sights and activities may be given such as:
   g. What I expect Whidbey to be like
   h. What I want to see at Whidbey
   i. My plans for this field trip

2. The class could be informed that there would be a portable tape recorder at the site and be encouraged to use it in recording sensory perceptions. The tape would then be played back to the group after their return affording them fresh material for discussion and further speeches. Some suggested topics for post-trip speeches are:

   a. Whidbey was different from what I expected
   b. I learned about . . . on the trip
   c. Bog life
   d. Beach critters
   e. Preserve our receation areas

UNDERSTANDING

Symmetry in nature can be related to geometric shapes.

ACTIVITIES

1. Pass out pieces of construction paper, cut into geometric shapes, and charcoal to each student. If natural drawing materials are available, the children may use them instead. Ask the children to look around them to find something in the area that fits the shape of the paper and draw it.

2. If an animal is sighted, let the group stop and observe it. Pass out 3 x 5 cards and have each child write what he would ask or say to the animal and what the animal would reply. This could be done during a rest period on a nature trail. Collect the cards.

   Back in classroom, the cards could be used as the basis for a lesson on writing conversation.

UNDERSTANDING

Learning through the senses.

ACTIVITIES

1. Each player is supplied with paper and pencil. Allow 10 minutes for the players to list all the nature sounds, sights, and smells. The player with the longest list wins.

   Anything in nature goes: the wind in the trees, leaves rustling, crickets chirping, a squirrel climbing, the smell of pine trees, and so on.

   The game can also be played with teams. Each team works together with paper and pencil in the hands of the team captain.

2. Have each child work with a partner and instruct one child in each pair to collect two objects. He will use the objects to make a noise and his partner must try to guess what he is using.

3. Again in pairs, let one child find one slippery thing, one warm thing, one smooth thing, and one rough thing to bring to his partner. The partner must close his eyes and try to guess the objects.

Edible and Poisonous Plants

UNDERSTANDING

In the Northwest there are a number of easily recognized edible plants that could provide emergency nourishment.

BACKGROUND INFORMATION

Many plants and animals were eaten by the Indians of the Northwest. Experimenting with native plants and animals is not only enjoyable but it helps prepare one to try unfamiliar foods. Learning to identify land and sea life will help one in knowing what can be eaten. While shelter, warmth, and safe water take precedence over food in an emergency, for comfort or for longer periods of time a knowledge of safe edible plants is important. Each student should know that: (a) Native foods should be eaten fresh within a few hours, (b) plants that are distastefully sharp or bitter should be avoided, (c) because a bird or animal can safely eat a plant does not necessarily mean that plant is safe for humans, (d) it is dangerous to eat large amounts of a strange food, (e) in general, plants are safer cooked than raw, and (f) mushrooms should never be eaten unless positively known to be safe.

The following list of edible plants is not intended to be comprehensive:

From late spring through fall, berries are common and nourishing. The following berries are among the best tasting: black caps, salmon berries, salal berries, wild strawberries, gooseberries, thimble berries, cranberries, kinnikinnick berries (cooked), and blackberries. The berries of the following plants are edible although not generally favored: crowberries, silverberries, black elderberries, blue elderberries, soopolallies, wild cherries, currants, cloudberries, teaberries, Pacific crab apples, hawthorne, and Indian plums.

Other plants producing edible fruit are: hazelnuts (in any stage of growth), pine nuts, and acorns (best when roasted).

Some plants whose roots are good when eaten raw are: dandelions, thistles, and clover. Some whose roots should be boiled are: bitterroot, blue camas, wild onion, bracken fern, sword fern, mountain lily, rice root, and oyster plant. The roots of the following are recommended for roasting: bracken, blue camas, dandelion, and thistle.

Shoots and leaves of edible plants are usually cooked by boiling. When leaves are boiled, two waters are used. It is customary to throw away the water from the first boiling, especially if the plant is somewhat bitter. Among plants whose

young shoots and leaves are edible when cooked this way are: bracken (shoots), dandelion (leaves), milkweed (young leaves), shepherd purse (leaves), and oyster plant (shoots). Some whose leaves and stems are edible raw are: miner's lettuce and Siberian miner's lettuce, salmonberry shoots, and fireweed stem centers.

Attached and growing seaweeds may be eaten raw or cooked. They should be taken only from below mid-tide level. Eat only small amounts because of the high iodide content.

People of Canada use the red algae found at mid-tide level, Rhodymenia palmata, known commonly as "dulse." Dulse is eaten raw or cooked, or chewed and occasionally it is seen in our markets in dried form. Until recent years many Scottish Highlanders chewed the dried herb as a substitute for tobacco.

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ACTIVITIES

1. Read aloud to the class either the entire book My Side of the Mountain by Jean George or the excerpt from this book found in the Wide Horizons series. My Side of the Mountain is a story of a boy who leaves home in New York and survives a winter in the Catskill Mountains, relying on his own resources and knowledge of the wilderness. This book should serve as a springboard for discussions of human needs and how they may be met in the wilderness.

2. Many children will know and recognize a number of the common edible wild plants. Most have access to some wild areas and with encouragement could bring in examples of them to be positively identified in the classroom. It would be well to correlate this activity with the work on classification. Once identified, these plants could be pressed and grouped into an edible plants collection.

3. The food collecting activity is most effective during April, May, June, or September. At these times of the year a good selection of edible plants may be found with relative ease.

   Foods should not be collected in great quantity, since most students will be quite satisified with a few bites. A sample menu follows:

Salad:	Dandelion leaves, clover leaves, sheep sorrel, young fireweed leaves, and Miner's lettuce.
Main Course:	Kinnikinnick berries, Shepherd's purse leaves, and bracken fern shoots (pick stems about 4-10 inches high, and remove brown, wool-like covering). Cook in boiling, salted water.
Dessert:	Salal berries, blackberries, wild raspberries "black caps," thimble berries, salmonberries, huckleberries, Oregon grape. These berries may be collected and eaten without preparation except rinsing.

UNDERSTANDING

Mushrooms are nongreen plants that produce new plants like themsleves by means of spores. Since some mushrooms are poisonous they should never be eaten in the wild.

BACKGROUND INFORMATION

Since mushrooms contain no chlorophyll they do not produce their own food. They get their food from the dead organisms on which they grow. Some are edible but they have no food value.

The umbrella-shaped top of a mushroom is called a cap and the rest of the plant is stalk. The cap is the reproductive organ and the stalk supports it. The part of the plant concerned with obtaining food and water grows below the ground. On the underside of the cap are many thread-like structures arranged like the spokes of a wheel. These structures called gills, produce the tiny spores that grow into new mushroom plants. The spores are not usually seen because they are so tiny. They are distributed by the wind.

ACTIVITIES

1. Make a spore print. Cut the cap from the stalk of a mushroom and place it, rounded side up, gill side down, on a piece of wax paper. Cover the cap with a glass jar or dish and leave it until the next day.

   Remove the covering and gently lift the mushroom cap. There will be a powdery pattern on the paper. It may be whitish, black, purple, or brown since different kinds of mushrooms produce different colored spores.

   To make the spore prints permanent, cover with another sheet of wax paper and heat with an iron set on low. Mount the prints on colored construction paper.

2. In the field make a sketch of a wild mushroom and label the cap, gills, and stalk. Note the color and finish the coloring later.

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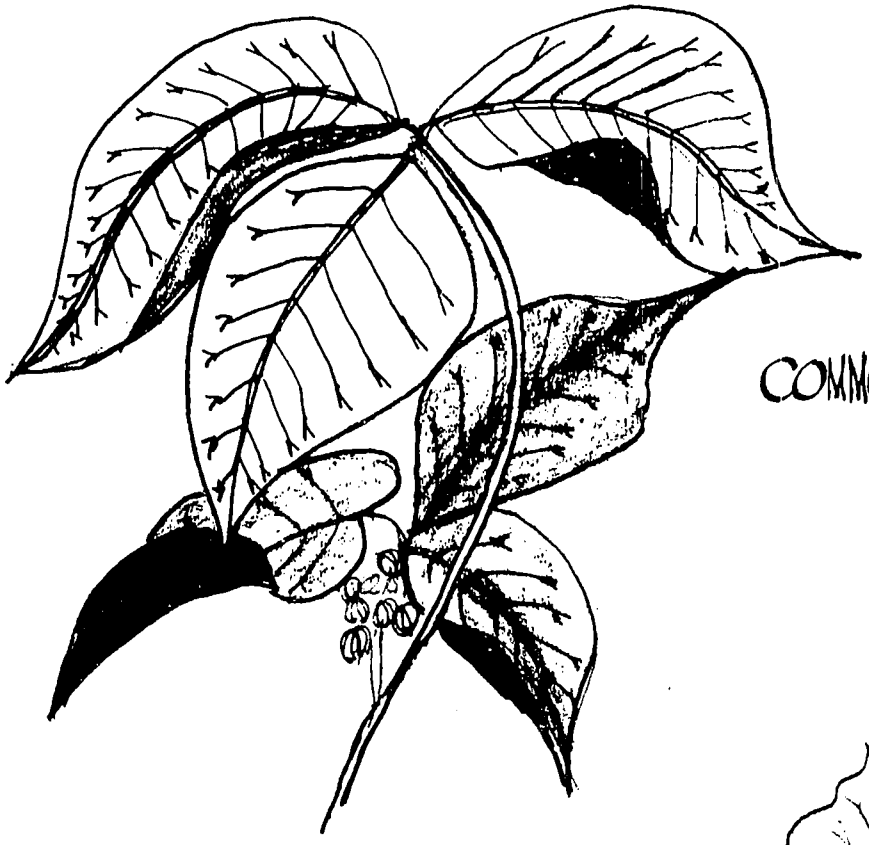
UNDERSTANDING

Most plants are harmless. Many are poisonous under some conditions. A few are poisonous under nearly all conditions. Some plants cause poisoning by contact but most cause poisoning only when eaten. It is dangerous to eat any unknown plant.

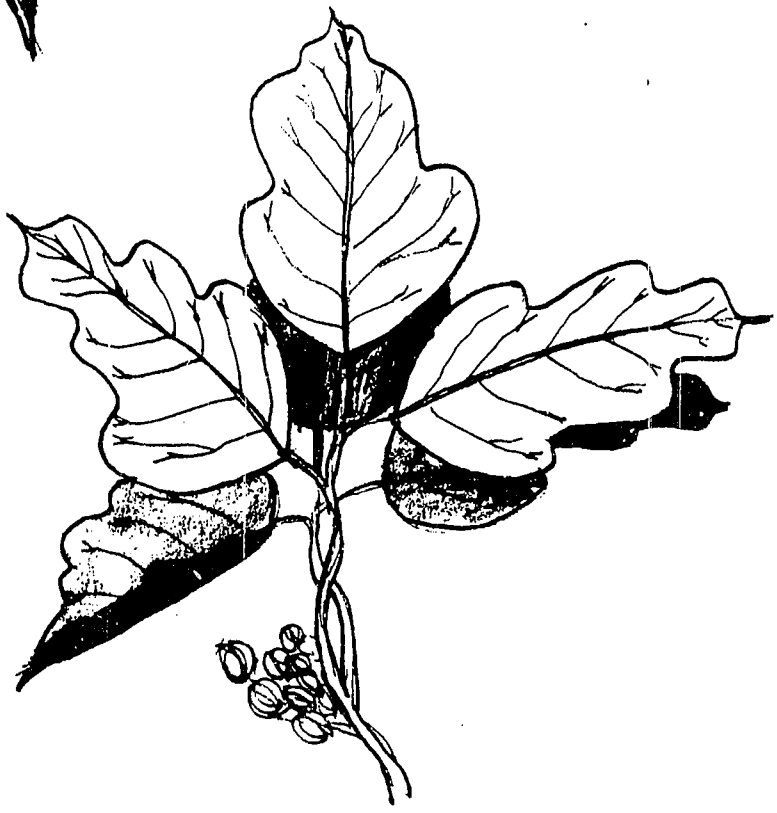
BACKGROUND INFORMATION

The most common causes of plant dermatitis are poison ivy and poison oak.

	Poison Ivy	Poison Oak
How it grows:	As a woody vine, the vine stems look like fuzzy ropes. As trailing shrubs mostly on the ground. As erect woody shrubs, without support.	Most often as an upright shrub with several woody stems growing from the ground. In open fields it can grow into large spreading clumps--sometimes six feet tall. In forests it becomes a vine and grows upward 25 and 30 feet.
The leaves:	Always in groups of three leaflets. The edges may be quite smooth or notched. Green through spring and summer, colorful in the early fall with scarlet, orange and russet shades.	Always grows in groups of three leaflets. The center leaflet is apt to be similar on both sides and have a definite "oak-leaf" look. The side leaflets often take irregular shapes. Sometimes all of the leaflets have smooth edges. They are glossy and leather-like.
The flowers:	Small, white flowers in clusters growing from the side of the stem, above a leaf.	They grow and are shaped much like common poison ivy flowers. They are about 1/4" in diameter, greenish white.
The fruit:	White or creamy and usually wax-like, but they can have a downy look. They have distinctive lines, like a peeled orange.	Creamy or greenish white, the size of small currants. The segments are clearly defined with lines.



COMMON POISON IVY



WESTERN POISON OAK

The following is a list of the most poisonous plants found in this area affecting humans and animals.

Plants Causing Dermatitis

Calla Lily
Cow Parsnip
Daffodil
Devils Club
Dog Fennel
Iris
Moleplant
Motherwort
Primrose (obconica)
Petty Spurge
Smartweed
Stinging Nettle
Wild Carrot
Wild Ginger
Yellow Jasmine

Plants Poisonous if Eaten

Baneberry--berries
Bleeding Heart--root
Bouncing Bet (sapanaria)
Soapwort--leaves
Bracken fern--all
Burning Bush--leaves
Buttercup--leaves
Castor Bean--seed
Christmas Rose--leaves
Daffodil--bulb
Daphne (mezereum)--berries
Death Camas--root, leaves
Dieffenbachia
Fall Crocus--bulb
Mt. Laurel--leaves
Nightshade--annuals--berries
Nightshade--deadly berries
Oleander--foliage
Pokeweed--root
Poison hemlock--all parts
Potato (sunburned)
Red Elderberry--berries
Rhododendron--leaves
Rhubarb--leaves
Foxglove--leaves and flower
Horaculeum Gigantum
Holly-berries
Horse Chestnut--nut
Horsetail--plant
Ivy--berries
Jimsonweed--all parts
Laburnum--seeds
Larkspur--leaves
Lily-of-the-Valley--all parts
Lobelia--leaves
Lupine--seed
Mock Orange--fruit
Monkshood--all parts
Scotch Broom--seeds
Skimmia--all parts
Spreading Dogbane--plant
Sweet Pea--seed and stem
Tobacco--leaves
Tansy--common leaves
Tansy Ragwort--leaves
Water Hemlock--all parts
Wild Cherry--leaves
Yew--all parts

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